American Machinist

Volume 56 NEW YORK, JUNE 8, 1922 Number 23

Scientific Management in the British Factory

Considered by Some a Revolutionary Movement—Why It Cannot Be Adopted as a Whole—Methods Not Popular with Organized Labor

By WILLIAM J. HISCOX

THE call of scientific management has been responded to in a manner typically British, the result being that even now it is enjoying but a doubtful sort of popularity. While in some cases its need is being frankly recognized and efforts are being made to secure its enthronement, in others it is being looked upon as a revolutionary movement and as such to be avoided as the plague. Yet it is in the latter connection that progress is being made, for unwittingly, perhaps, its opponents are succumbing to its charms and improvements are being effected which, although not openly under the banner of scientific management, are at least indebted to it for the inspiration. The enthusiasts swallowed the doctrine wholesale, and failing to achieve results, condemned it. This because they did not understand. The others regarded it with suspicion but, recognizing its effect upon the production of America, commenced a progressive campaign which embodied its essentials.

So for the moment the popularity of scientific management is of a doubtful character, for its erstwhile champions now openly deride it and its opponents make use of its ideals without acknowledgment. But, when all is said, it is a principle rather than a system, and a principle may be subject to adoption without being destroyed. The seed has been planted and the tree will grow but the difference in the soil will naturally affect the appearance. In America it is a strong and mighty tree, of huge girth and of comprehensive embrace; but in England it is small and compact but none the less virile. It cannot be otherwise, for the conditions in the two countries are utterly dissimilar, and there is no room here for the giant growths of the States. That is why scientific management, as practiced in America, cannot be imported, and because those who have attempted to do so have failed, it does not mean that adoptions are impossible.

There are many here who have a wholesome respect for the business methods of America, and if these methods are accepted as proof of what can be done in given circumstances, appreciation will have a stimulating effect. But it is a mistake to assume that there are no brains in the Old Country, and that the future of industry depends upon the importation of methods from abroad. One industry has been built up by ideas inspired by the conditions we were called upon to meet, and at that time there were no precedents to act as a guide. Our American cousins had the precedent of our labors, and were thus able to avoid many pitfalls. They used our ideas as a means of effecting improvements, and they were thus enabled to commence upon a higher level than we had attained. Their own peculiar circumstances had to be catered to, and in their efforts to solve the problems new ideas and methods were evolved. While this development was taking place over the water, we at home were not standing still, but our development was of a somewhat different order. We were moving forward, but not so rapidly, because the circumstances were not so vital. The industrial position just prior to the World War made it necessary for us to increase our efforts, and naturally enough it was to America that we turned our eyes. We saw the methods by which she had surmounted difficulties and was forging ahead, and we were inclined to examine these methods with a view to adoption to our own needs.

> PLANT LAYOUT, types of shop buildings and the attitude of employees are all governing factors in the success of new systems.
>
> British manufacturers do not discredit scientific management, but do believe that the adoption of any system in toto as a panacea for all ills is fraught with great danger unless the remedy be administered in homeopathic doses.

The mistake was that many failed to do what the Americans had done previously, viz., to profit by the experiences of others and avoid pitfalls. The Americans started off with an American adoption of British ideas, specially designed to cater for her own peculiar requirements, and what is now wanted in this country is a British adoption of American ideas, specially designed to cater to its present-day requirements.

We should be able to lead off on a higher plane—that is to say, the methods we evolve should be more efficient when applied to British manufacture than are the present American methods in relation to their own manufacture. If a man invents something, all the other inventors seek to improve upon it, not to copy it. They use it as a spring board, and we must do the same with methods. No one man can draft out a system and say that it covers the beginning and the end of scientific management. It is at present only in a crude shape, full of possibilities, but as yet undeveloped. The seed may be cultivated in all countries and applied to all industries, but the methods employed will be dissimilar.

The measure of success attained depends upon the

efficiency of the method employed to deal with the specific problem. The monopoly is held by no one country or firm. It is purely a question of efficient application, and so long as the *principle* is thoroughly understood, the *application* is a mere matter of detail as it automatically presents itself.

Some British firms boast of their Americanized systems, but they are wrong. The actual systems (in entirety) operating in America cannot be applied with success in any British factory. British foremen and department heads are sent to America to see the methods employed, and while this is all good, these British foremen could not apply those methods if they would. This is no reflection upon their personal ability, for no man, no matter how fortunate he may be in the matter of brains, could do it. But an examination of those methods would undoubtedly suggest an adoption, and it is for this reason that the foremen are sent.

Part Acceptance of Scientific Management

We have accepted scientific management, so far as it applies to sectional control. We have discarded the "all rounder" and are cultivating the "specialist," and in theory, we believe in payment by results. Unfortunately for us, many of our factories were built before the scientific era dawned and we have not advanced far enough to say "Scrap the lot, and let us rebuild." We do the best we can with the means at our disposal, and one of the reasons why our methods must rise superior is that greater skill is necessary to exploit the possibilities of our somewhat antediluvian style of factory.

Our attempts at "mass production" upon the American plan have failed, but our "repetition production" is going strong, because it fits in with the need. We have, of late years, given more attention to the organization of our toolroom, and we are coming round to the belief that this is a productive department in the truest sense of the term. The "aids to machining" are many and various, and "work by hand" is practically confined to assembling. The "fitter" of a decade ago, who could "turn his hand to anything" has disappeared, and in his place is the "specialized assembler" who handles his one little section so rapidly that the erstwhile "fitting department" is enlarged almost beyond recognition to allow for the units it is necessary to lay down at one time to permit of continuous employment.

We have realized that "mechanical aids" are necessary in the interests of rapid and economical production, and our machining departments are well equipped. The operations on each and every detail are calculated to a nicety, and the old "all embracing" process order is replaced by two or more orders of a more definite character.

We have a planning department, and output from every manufacturing section is pre-determined. We no longer expect the department foreman to calculate his times or rates—the expert rate fixer is available for the purpose. The works manager is not now expected to run the factory single-handed. He has the assistance of experts who between them control the factory organization. There is the works engineer, the production manager, the progress manager, the inspection manager, the commercial manager, and the like. Each is a specialist, with ability and opportunity of concentrating upon the one thing which immediately concerns him.

Cannot the principle of scientific management be discerned here? And yet this name is not mentioned in the factory. The methods adopted are dictated by common sense and a keen appreciation of the need of product. It is recognized that it must be produced to sell, which means that the cost incurred in manufacture must be low enough to permit of a margin of profit between that and the selling price, which must be low enough to attract the notice of the buyer.

We therefore endeavor to reduce costs by quickening output, for this is the only way to insure economical production. We have a factory and upon this we have to pay the standard rent, rates and taxes, no matter now much (or how little) is being produced. The power and lighting charges are not entirely standard, but increased production in the building already equipped with power and light does not materially increase these charges, and the same may be said in respect to the management and administration charges. It is the direct labor charge which alone shows any marked increase, and this again is quite disproportionate to the increase in production. It is not that the wages of the individual are reduced—rather they are increased—but the cost per piece is reduced. The man who produced one piece in one hour, at a labor cost of 2s. 1d. now turns out four pieces per hour, at a labor cost of 9d. each.

Our organized workers are not taking kindly to the idea of "payment by results" but individually they are rather keen upon it. At the present time the methods of times fixing are not so scientific as they might be, and until something is done in this direction there is sure to be some opposition. In spite of the progress already made, factory organization does not yet commend itself to the workers, and our methods of management must be further developed before the confidence of the workers is gained.

It is a question of thoroughly understanding the needs of industry and applying the correct remedies. Everything under the sun is good, so long as it is in its right place and kept there. We know that the methods of twenty years ago are inadequate today and we have to move with the times. Our population is increasing and employment must be found. We have to think of industry as something necessary to preserve the whole human race and not regard it as purely personal.

A Modified System

In England this is being appreciated but it is a slow process. We have, however, accepted the principle of scientific management and we are putting it into practice in our own inimitable way. We are not content to copy the American system, for that will not assist us, but we *are* out to improve upon it inasmuch as we must make it fit in with our own requirements.

Scientific management has not "had its day," as many people aver. In fact, so far as this country is concerned, its day is only just dawning. Before long the possibilities will become more apparent and exploitation will follow. It is thought by many that our manufacturers are too conservative to grasp at the opportunities offered and no doubt this is correct. Fortunately for the country, however, there is a band of business men who appreciate what business really is and who frankly enjoy their calling. They have no use for hoary traditions. neither do they possess conservative tendencies and sooner or later they will assume control and in the reconstruction which follows, scientific management will undoubtedly come into its own.

Standard Cams for Brown & Sharpe Automatic Screw Machines

Making Special Cams Unnecessary in Many Cases—Cams for Forming and Cutting Off Often Interchangeable—Marking and Indexing Cams

By D. A. NEVIN
Chief Engineer, Watters Corporation

IN ALL factories where the product includes screw machine work there frequently arises the question of making special cams for parts required in considerable quantity but which are not to be manufactured permanently.

In presenting the standard cams, Figs. 1 to 5, it is not claimed by the writer that they will cover all varieties of plain and threaded parts, a few of which are suggested in Figs. 6 and 7; but it is the purpose to show how they may be made the foundation of a system in which each cam is detailed on a card and numbered so that after a required set of cams has been computed the nearest standards may be selected from the list and the expense of making special sets of cams thereby greatly reduced. As the number of cams increases, the system naturally becomes more complete and therefore of greater value. An order of operations (Figs. 9 and 10) is furnished the operator the same as when special cams are made. It specifies by symbol number the cams to be used, also the spindle speeds and gearing, and is an improvement over the old method of requiring the foreman or set-up man to piece together a set of cams, making a guess at the proper feeds and speeds.

This article refers to fast jobs on the No. 00 machine, though fast jobs on the No. 0 machine can also be handled economically by this method. For all work on the No. 2 machine it is advisable to make individual sets of cams. However each cam of these sets should be numbered and card indexed as there is always a possibility of using the cross-slide cams and sometimes the lead cam for other work.

The cams illustrated in Figs. 1 to 5 will make all of the parts shown in Figs. 6 and 7, with only a slight difference in production than if special cams were used.

When necessary to design special cams, all similar parts to be made should be grouped. For instance parts *H* and *K* (Fig. 7) can be made with the same cams, provided the cut-off cam is made to suit *H*; therefore it is well to make first those cams required to have the most throw. A slight difference in the length or lead of the thread does not necessitate a special thread lobe,

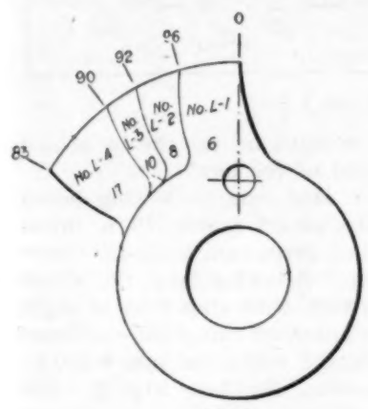
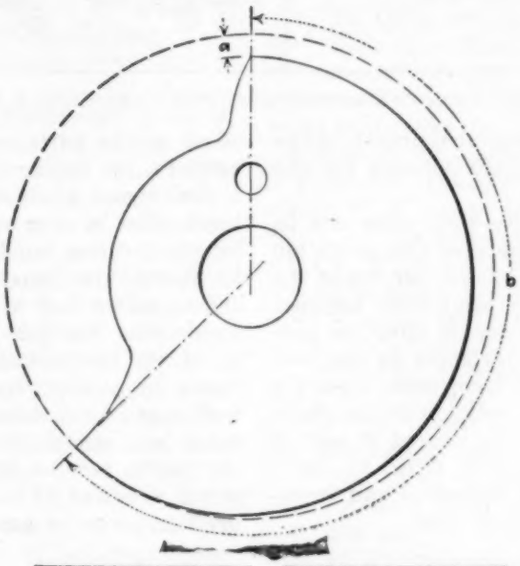


FIG. 1



Number	Throw	Halts.
S-1	0.040	60
S-6	0.040	80
S-9	0.070	60
S-10	0.100	60
S-3	0.100	70
S-2	0.110	70
S-13	0.110	80

Number	Throw	Halts.
S-11	0.120	60
S-12	0.140	60
S-4	0.160	85
S-7	0.175	60
S-5	0.175	70
S-8	0.175	90

FIG. 2

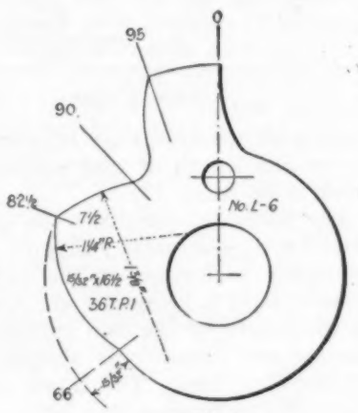


FIG. 4

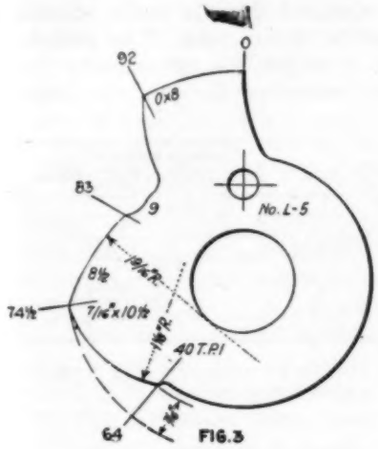


FIG. 3

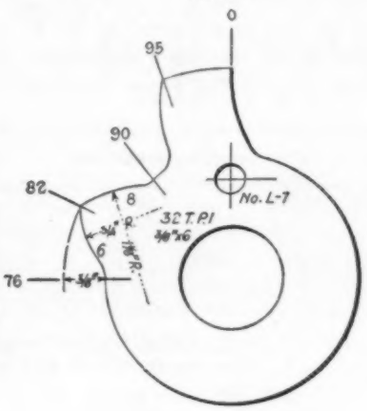


FIG. 5

FIGS. 1 TO 5. STANDARD CAMS

as the purpose of the thread lobe is to start the threading die and it is made with sufficient clearance to allow the die to thread itself on the work and to be threaded off again by the reversal of the spindle. The compression of the coil spring in the die holder makes allowance for considerable variation in the length of the threaded part.

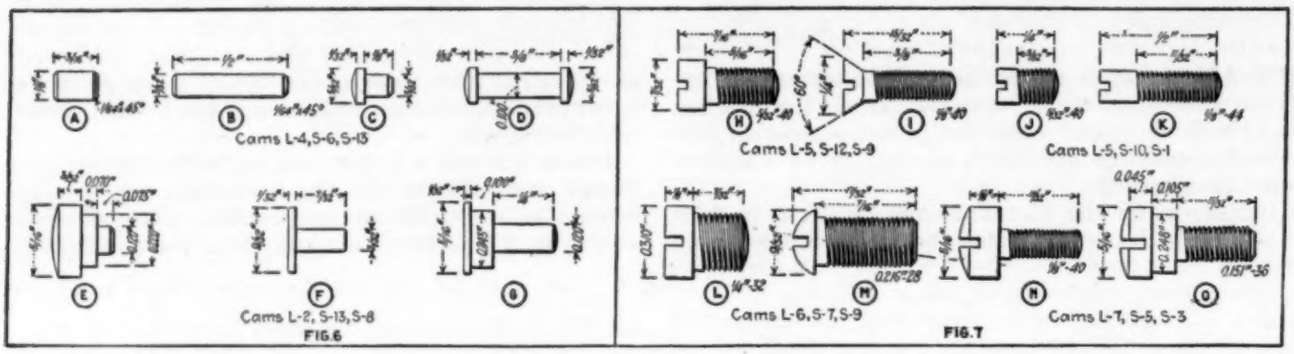
As is generally known, cams used for forming and cutting off operations are interchangeable providing the throw and length of cam surface are suitable for the work to be done.

For forming operations the cross-slide cams can be used for a great variety of jobs, because this operation is usually performed on the end of the bar while the finished part is being cut-off, therefore a wide variance in the length of the cam surface has no effect on production and causes only a small variation in the feed of the form tool. The throw of form cams does not vary greatly because they have no relation to the diameter of the work, as for instance the screws *H* and *M* (Fig. 7), also parts *A*, *B*, *C* and *D* (Fig. 6), have practically the same difference in diameters and therefore require the same throw of form cam.

are given a standard symbol number. The throw and length of cam surface is stamped on each cam as shown in Figs. 1 to 5.

In Fig. 8 is shown an order of operations for parts *E*, *F* and *G*, Fig. 6, made from screw rod, the throw of the form cam being relative to the maximum and minimum diameters of the different parts and the throw of the cut-off cam relative to the largest diameter of all of the parts, adding 0.014 in. for the bevel and 0.005 in. for facing the end of the bar.

The cams required are lead cam with stop seven hundredths of cam surface, cut-off cam 0.175-in. throw by ninety-three hundredths, form cam 0.101-in. throw by ninety-three hundredths. Selecting from the standard cams we find a lead cam with stop lobe of eight hundredths, No. L-2, Fig. 1; cut-off cam 0.175-in. throw by ninety hundredths, No. S-8 and form cam 0.110-in. throw by seventy hundredths, No. S-2, Fig. 2. The lead cam is cut down sufficiently to allow for all but extra long parts. The rise and drop is made according to the templet for 6 to 35 sec. jobs. The pinhole is not required to be used on the No. 00 machine for driving purposes and by removing the pin, the cams may be located in any suitable radial position. However it is well to make it a rule when laying out to start all cross-slide cams at zero so that they may be the more interchangeable if locating pins are used.



FIGS. 6 AND 7. PARTS THAT CAN BE MADE BY THE CAMS SHOWN IN FIGS. 1 TO 5

ORDER OF OPERATIONS	SPINDLE SPEED 1087 R.P.M.	HUNDREDTHS OF CAM SURFACE	CAM NUMBER
Feed stock to stop	11 Revs.	7	
Cut off 0.175 inch travel at 0.00115 feed	152 "	93	
Form while cutting off 0.101 inch travel at 0.00066 inch feed	(152 ")	(93)	
Total revolutions to make one	163 "	100	
Time for one piece, 9 seconds. Gears: 60 driver, 54 driven			
Net in 10 hours, 3600. Maximum surface speed of stock, 89 ft. per minute			

FIG. 8. PRELIMINARY LAYOUT FOR PARTS *E*, *F* AND *G* (FIG. 6) IF MADE FROM SCREW ROD

ORDER OF OPERATIONS	SPINDLE SPEED 1492 R.P.M.	HUNDREDTHS OF CAM SURFACE	CAM NUMBER
Feed stock to stop	14 Revs.	8	L-2
Cut off 0.175 inch travel at 0.00111 inch feed	157 "	90	S-8
Form while cutting off 0.110 inch travel at 0.000791 inch feed	(139 ")	(80)	S-13
Lost time	3 "	2	
Total revolutions to make one	174 "	100	
Time for one piece, 7 seconds. Gears: 60 driver, 42 driven			
Net in 10 hours, 4,600. Maximum surface speed of stock, 122 ft. per minute			

FIG. 9. PRELIMINARY LAYOUT FOR PARTS *E*, *F* AND *G* (FIG. 6) IF MADE FROM BRASS

ORDER OF OPERATIONS	SPINDLE SPEED 927 FORD.	SPINDLE SPEED 1273 BACK.	HUNDREDTHS OF CAM SURFACE	CAM NUMBER
Feed stock to stop		15 Revs.	8	
Cut off 0.140 inch travel at 0.0012 inch feed		114 "	60	S-12
Form while cutting off 0.070 inch travel at 0.0006 inch feed		(114 ")	(60)	S- 9
Index turret 5 times, reverse spindle clearance		8	4	
Thread on 16 threads at slow speed	16	21	10½	S- 5
Reverse spindle, thread off		16	8½	
Index turret		17	9	
Total revolutions to make one		191	100	
Time for one piece, 9 seconds. Gears: 60 driver, 54 driven				
Net in 10 hours, 3,600. Maximum surface speed of stock, 83 ft. per minute				
Maximum surface speed to thread, 30 ft. per minute				

FIG. 10. PRELIMINARY LAYOUT FOR PARTS *H* AND *I* (FIG. 7)

SKELETON ORDER OF OPERATIONS	SPINDLE SPEED 792 FORD. & BACKWARD	HUNDREDTHS OF CAM SURFACE	CAM NUMBER
Feed stock to stop		5	
Cut off 0.175 inch throw			
Form 0.100 inch throw			
Clear		6	
Thread on 18 threads and reverse spindle	18	7	
Thread off 18 threads	18	7	
Index turret		5	
Total revolutions to make one	257	100	
Time for one piece, 20 seconds. Gears: 20 driver, 40 driven			
Net in 10 hours, 1600			

FIG. 11. PRELIMINARY LAYOUT FOR PARTS *H* AND *O* (FIG. 7) IF MADE FROM HARD STEEL

An order of operations similar to Fig. 8 should be worked out for each representative group and figured according to the proper feeds and speeds. Drawings and cams similar in throw and length of cam surface

A numerical list of all cams should be kept for the purpose of taking out new symbol numbers and each cam should be entered on an individual card so that it may be filed in order according to throw.

Parts can be made from brass or hard steel with the same cams, using suitable feeds and speeds, as for example the order of operations shown in Fig. 9 for the parts *E*, *F* and *G*, Fig. 6, if made from soft brass.

In designing lead cams to become standards for threaded parts, a variety of thread lobes (designed according to various speeds and pitches of threads) are laid out on transparent paper for comparison.

Usually the selection of a few varieties will answer most requirements. These are stamped with throw of cam, hundredths of cam surface, and pitch of thread for which the cam was designed, the latter for comparison when using the cam for making other screws. The cam shown in Fig. 3 was designed for use with a fast spindle speed backward and intermediate spindle speed forward, while the one shown in Fig. 4 was designed for a fast speed backward and slow speed forward and the one shown in Fig. 5 for the same speed forward and backward.

In order to select a suitable thread-lobe cam for making a screw it is necessary to find the proper gearing to rotate the cam at a speed corresponding to the required spindle speed. As an example, a ½-in. 36 pitch screw, 1¼ in. long with a ⅞-in. diameter head made from hard steel would require surface speeds of approximately 25 ft. per min. for threading and 65 ft. per min. for forming and cutting off or a suitable spindle speed of 792 r.p.m. forward and backward.

In the skeleton order of operations (Fig. 11) it is shown that if the thread cam shown in Fig. 5 is used, the number of hundredths of cam surface for threading (or 7) divided into the eighteen revolutions required for threading, equals 257 revolutions of the spindle to make one piece. Referring to the table in the B. & S. instruction book for the No. 00 machine, under 792 r.p.m. we find the nearest number to 257 is 264, requiring gears 20 driver and 40 driven. If the required spindle speed was 927 r.p.m. gears 20 driver and 34 driven would be used with the same cam. The amount of cam surface not used (Fig. 5) approximately establishes the minimum feed for the cutting off and forming operations, but as a rule this does not interfere with the selection of the lead cam. In the example above the feed for cutting off and forming (also using standard cams) is 0.00086 in. and 0.0005 in. respectively. The omissions in Fig. 11 are to make clearer the method of computing to obtain proper gears.

If a thread lobe is laid out for the screw given in the above example the outline will be found to match closely with that in Fig. 5, designed for a different pitch screw made from soft steel with a correspondingly faster spindle speed.

Threaded and plain bushings, collars and parts requiring a variety of turret operations can also be made with a large percentage of standard cams, although those lead cams having more than two lobes in addition to the stop are usually limited to machining the work for which they were designed. Cross-slide cams having a small amount of cam surface occur frequently in this class of work and may be used for a great many different parts.

A few of the cams are used so frequently that it is advantageous to duplicate them. Parts to be made in large quantities should have special cams designed for the purpose of saving every fraction of a second, an economy which will become noticeable in a few weeks. The nature of the work, number of machines and cams on hand, etc., are all factors which determine to what extent the standard cams may be used.

Enlargement of Cast Iron by Heat-Treatment

BY GUY L. BUNCH

With reference to an editorial query appended to an article by Ivan C. Beach on the subject of "Enlarging Gas-Engine Pistons," appearing upon page 638 of *American Machinist*, my experience may be of interest.

While serving as assistant inspector in the Bureau of Ordnance, Navy Department, I made a series of experiments and found that a 12-in. cast-iron projectile was enlarged 0.017 in. at the bourrelet, while at the base of the same projectile the swelling amounted to 0.020 in. The test was made upon the body of a 12-in., 870-lb. standard Navy target projectile that had been cut off just forward of the bourrelet, and was for the purpose of determining whether or not it was possible to reclaim projectiles that had been machined below the limit of size for acceptance.

Three test bars were taken out of the projectile by means of a hollow drill and laid aside to be used to check by. Three others were taken out and heat-treated at the same time and in the same furnace with the mass, and still three more were taken out of the mass after it had been heat-treated. All test bars were turned to a uniform diameter of 1.129 inch.

The results were rather astonishing, particularly as there was a general feeling that cast-iron heated to a cherry red would be deteriorated by the treatment. The raw bars pulled within 300 lb. of the original test upon the same material, the bars that were treated with the mass pulled about 15 per cent higher than the raw bars, and the bars that were taken out after treatment of the mass showed an increase of 12 per cent in strength over the raw bars. The bars cut from the mass before treatment and treated with it showed an enlargement of from 0.005 to 0.0075 in. in diameter and a slight increase in length. Every care was exercised to locate the measuring points upon the bars in exactly the same place, and each bar was seated privately so that there was no possibility of mixing them.

The result of these experiments would seem to indicate that cast iron was not only increased in size by heat-treatment but that its material characteristics were also improved thereby. Whether or not the composition had anything to do with the result the experiments did not go far enough to determine, and this would seem to be an excellent field for further experimentation.

The Foreman and the Community

BY A. W. BROWN

As a rule, neither the management nor the mass of workers thinks much of "the community"—who constitute it, where they live, move and have their being and what their rights may be. Probably the foreman is much better fitted than either the management or the working class under him to give a thought to that "class," which is not a class, because it comprises all classes, and which has at least an indirect interest in all industrial comings and goings, thinkings and doings.

Problems of the Die Head Manufacturer

Factors Affecting Design and Manufacture—Construction and Details of Manufacture—Why Parts for Special Threads Are Costly

By C. W. BETTCHER
Sales Manager, Eastern Machine Screw Corporation

IT MAY safely be assumed that few users of self-opening die heads realize the complexity of the problem with which the manufacturer of this class of tool is confronted.

To gain some idea of the magnitude of this problem, it is necessary to consider the following factors: (1) The variety of thread forms used upon articles of modern manufacture; (2) the multiplicity of sizes and pitches in which each thread form must be produced; (3) the various kinds of material upon which threads are cut, and (4) the kind and condition of the machine and the degree of intelligence and interest displayed by the workman who operates it.

Of thread forms we have in common use the U. S., V, Acme, Whitworth, British Association, Cycle Engineering, French, Standard-International, pipe threads and many special shapes. Each may be required in either right- or left-hand, in any pitch from 3 to 110 per inch, and of any size from ¼ to 3 in. in diameter. Added to the above list is the possibility of having to furnish any one or all of them in double, triple or even quadruple pitch.

The complexities are still further swelled by the fact that many kinds and sizes of thread may be cut with several sizes or styles of die-head, making it necessary for the manufacturer to increase his stock of chasers by that number in order to meet all requirements. In fact, a recent inventory at this factory disclosed approximately 1,300 varieties of the combinations given above.

While this outline is designed to suggest the great possibilities of the self opening die head, it may serve in even greater measure to emphasize the importance to the customer of adopting for his work some form and pitch of thread that is already to be found in standard tables. The special thread not only is usually an arbitrary requirement on new work, but actually increases production costs for the reason that the special tools and gages must be made at a cost many times in excess of the cost of standard equipment, to say nothing of longer time it will take to get them. It is the practice of the Eastern Machine Screw Corporation, and I believe of most die head manufacturers, to simply make an extra charge for the cost of the hobs when special chasers are ordered and to absorb the other losses.

The manufacture of chasers is work that cannot be hurried. In ordering new or special thread forms, pitches, etc., the customer should remember that any deviation from standards already set involves the making of tools for the production of the new chasers and that with the making hardening, grinding, and testing of these tools, thirty operations are introduced, all of which tend to lengthen the time required for deliveries. Allowances in delivery should be made upon all orders for chasers that differ in any detail from those that have hitherto been made. A recent inventory disclosed the fact that there are well over 1,750 different kinds of chasers in stock ready for immediate shipment. When it is considered that in some of these chaser sizes hundreds of chasers must be available on any one order it will be seen what this investment must mean in order to give the proper service to the customers in the matter of chaser deliveries.

THIS OUTLINE, in addition to suggesting what is possible in self-opening die heads, emphasizes the importance of selecting threads wherever possible from tables already considered as standards.

Following such a procedure will mean not only more prompt service in the matter of chaser deliveries but also better deliveries from the manufacturer of taps and gages, and lower costs.

Difference of material upon which threads are to be cut involves a difference in minor details of the tools that are to cut them, even though the thread characteristics may remain the same. Though cold-rolled screw stock is by far the most commonly used material upon which threads are cut, nickel, chrome-nickel, chrome vanadium and other steels (some heat-treated) cast-iron, cast brass, bar brass, tubing, aluminum, fiber, hard rubber and even celluloid are often used. Fig. 1 shows a few examples of the threads and materials. Each material requires a careful study of its characteristics in order to be sure that tools will render satisfactory service upon it.

Self-opening die heads are used upon automatic single and multiple spindle screw machines of different designs and principles, bolt threading machines, hand screw machines, lathes, drill presses and many special machines. In some of them the die head revolves while the work remains stationary, in others it is the material that revolves. Some rotate both work and head at differential speeds. All of these things have a bearing upon the kind of die head to be used and must be taken into consideration by the manufacturer who supplies the tools.

Not the least important of the variable factors is the workman who has the handling of the tools. Though the equipment may be beyond criticism and perfectly adapted to the work it is expected to do, all the study and forethought of the tool manufacturer may speedily be brought to naught by a careless, indifferent or ignorant workman who may run the tools at speeds for which they were never designed or may allow the supply of lubricant to fail at a critical moment.

The self-opening die head has, however, reached such a point of perfection in detail, rigidity and reliability

of action that with proper supervision in the matter of grinding chasers and suitable instruction to the workman in the use of it, the tool can be depended upon to produce work upon a quantity production basis that will equal in accuracy the best product of the toolmaker's skill.

The following points are essential to a successful die head. It must be simple in construction so that it will function instantaneously; it must be strong and rigid that it may stand up to its work continuously without its operation being affected by working conditions; it must hold the chasers firmly and in the most advantageous manner so that there will be no yielding under pressure of the cut; all parts must be carefully hardened to insure against undue wear; and all parts must be ground after hardening to extremely close tolerances so that old and new sets of chasers may be interchanged as necessary and the changing from one style of die head to another style of the same size effected without difficulty. These requirements involve not only the most exacting methods of manufacture but a system of inspection that will enable the manufacturer to keep the limits of tolerance under his strict observance and insure perfect workmanship and interchangeability.

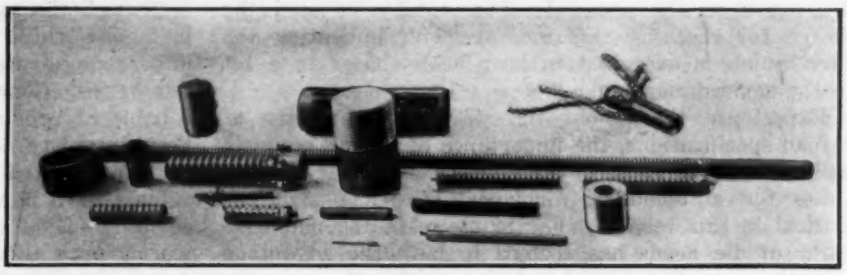


FIG. 1. EXAMPLES OF THREADS AND MATERIALS

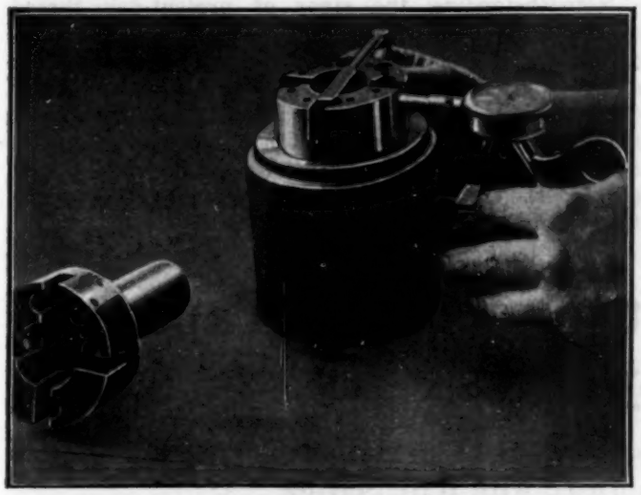


FIG. 2. TESTING THE HEADS FOR SYMMETRY

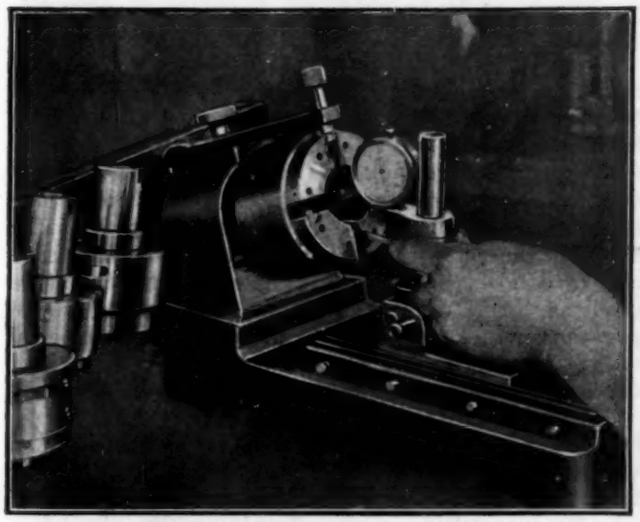


FIG. 3. TESTING THE CAMS FOR RADIAL POSITION

An important feature of the construtcion of a self-opening die head is the slot in which the chasers move. These slots must be ground to accurate dimensions so that chasers, old or new, will be a close sliding fit without perceptible shake, else chattering and consequent imperfect work will result. Besides accurate dimensioning it is of extreme importance that the slots be symmetrically disposed with relation to each other and to the axis of the die head.

In Fig. 2 is shown how the heads are tested in this respect. Go and no-go gages are used to keep the width and depth of the slots within limits while the bar gage and indicator enable the inspector to detect errors of a very small fraction of a thousandth in location. Tolerances, even on large scale production, are held as closely as in the most exacting tool work.

In Fig. 3 may be seen the method of testing the cams to make sure that each bearing surface is exactly the same distance from the axis of the head. Here, again, the tolerance must be very close, for any variation in this respect would mean that the work of threading would fall unevenly upon the chasers, resulting in bad work and the rapid deterioration of the chaser that was bearing the brunt of the burden.

Turning now to the chasers we find that it is a matter of vital importance in tooling up for their manufacture for exactly the right amount of clearance. However slight this may be, it is very essential to a free cutting tool. We have to control the clearances from the cutting edge back around the screw and also from the throat to the rear. Though these clearances are difficult to measure, they must be maintained within definite and very close limits.

The length of each chaser is another important feature; "length" in this case meaning not the over all length but the distance between the pitch diameter of the thread and the point where the chaser takes its

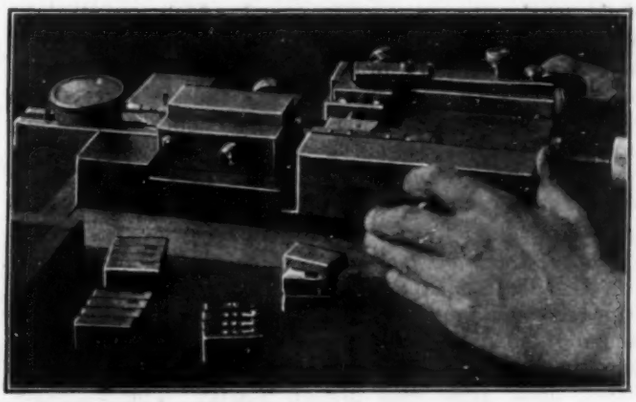


FIG. 4. TESTING THE CHASERS FOR LENGTH

bearing upon the cam. In Fig. 4 may be seen the device for checking this measurement, indicating the care which is exercised to keep each chaser in a set to the same dimension.

Experience throughout the war in the matter of thread specifications, the importance of having accurate and smooth threads in high-speed engines, such as those for automobiles, airplanes, etc., has made us critical in this respect. For many years the manufacturer of die heads has seemed to have the advantage over the manufacturer of taps, but within the last year or two the latter has made very rapid strides and taps are now available that will cut threads beyond criticism.

Threads on chasers are cut by the hobbing process and as these threads can be no better than the hobs that cut them, the designing and making of the latter constitute no small part of the problem with which the manufacturer must deal. This phase alone calls for a vast amount of gaging and testing apparatus in the inspection department.

Though the self-opening die head cannot be said to be a new thing as mechanical inventions go, it has undergone a wonderful development within the past few years. Considered but a short time ago as a tool capable of producing a "good enough" thread, it has been improved by strengthening its parts, closing up its limits of tolerance, and extending its range of usefulness until now it may be depended upon to produce in hundreds of thousands many kinds of threads and worms once thought impossible for it, and this to a degree of accuracy hitherto regarded as unattainable except by the most laborious and painstaking methods.

Notwithstanding the rigor of present-day thread specifications in the matter of form, lead and smoothness of finish, the die head is meeting them with ease and regularity, and this has been made possible largely through the efforts of a comparatively small group of manufacturers who, having faith in the possibilities of the tool and the determination to demonstrate it have devoted their time and skill to overcoming the difficulties one by one as they have arisen.

Time and Motion Study vs. Red Tape Wage Systems

Premium Earnings Should Not Be Used to Control Wage Fluctuations—Time and Motion Study Is Too Frequently Confused with Rate Setting

BY GAYLORD G. THOMPSON
Production Engineer, Pawling & Harnischfeger Co.

"IT APPEARS to me that we are beating around the bush in our methods of wage payments." These were the words of a general manager, uttered at an executive meeting. "I had occasion to visit ——— & Co. the other day," he continued, "and I was very much impressed by the small clerical force they employ to keep records of their labor and manufacturing costs. They have no premium or piece work in their plant, consequently prodigality of forms and records does not exist. The workers are paid on a flat hourly basis. Upon completion of a job, it was not necessary to pass the labor record through a multitude of hands to complete the calculations of labor costs. I will venture to say that if I take any foreman in our shop and walk with him through any department with which he is not familiar, he will be unable to tell me which of the workers, judging by their application to their work, are on premium and which on straight work. When I walk through the shop and witness an apparent equality in production and physical exertion of employees on premium jobs and those working on a flat wage rate, I am forced into the opinion that our premium system is availing us nothing. It appears to me that our premium system has degenerated from an incentive toward increased production, to a red tape method of the application of a wage payment system."

At this meeting the subject of retrenchment predominated. To the exponents of the premium system of wage payments supplemented by the application of time and motion studies, the words of the general manager contain a challenge to the arguments for efficiency based upon time and motion study. They perhaps typify the opinions of many executives who are inclined to discount the value of time and motion studies as a basis of establishing efficient manufacturing methods and rates. Evil germinates from a cause, consequently every evil attributed to the functions of time study must have its cause. The harvest resulting from the seeds of time study is in proportion to the knowledge and care taken in their planting and cultivation. To condemn time study, when the fault lies in the misapplication of its fundamental principles, is just as logical as mixing yellow and blue together and condemning the mixture because it is not white instead of green.

There was a time when the majority of manufacturing concerns having premium systems in their plants, would hire their employees at a certain rate per hour that was satisfactory to the employee regardless of whether he worked premium or piece work. Premium earnings of 10 to 15 per cent in excess of the flat wage rate of the worker were considered sufficient incentive for increased effort and met with satisfaction because the wage rate was high enough to counteract any tendency toward dissatisfaction should the worker be called upon to perform duties on which no premium rate had been established.

Before the World War, the evolutionary development of time study had progressed so far that time study was becoming an essential factor in progressive and efficient manufacturing methods. Unprecedented prosperity, resulting in riotous clamor for production regardless of cost, had the effect of partially breaking down the structure constituting the fundamentals of time and motion study. In the efforts to comply with

the demands of labor for increased remuneration, premium rates were established from past performance records of employees. This was found to be the most convenient source of realizing quick results. Right here is where we discover the cause of the "apparent equality in production and physical exertion of employees on premium jobs and those working on a flat wage rate."

When premium rates are based upon the past records of employees without due consideration of the effect of inefficient operation methods, the whole affair resolves itself into a red tape method of wage payment and nothing more. Premium rates as based upon the conclusions of time study are supposed to incorporate an element of incentive toward increased production. Rates which are based upon the performance of the individual rather than upon time study, will eventually defeat their purpose because the facts relating to the details of the operation affected are not available. Thus we have as a result of all this, nothing more than an estimate.

In carrying out their plans of retrenchment, many manufacturing concerns will find that their employment managers have been hiring help on the basis of so much per hour and a promise of additional premium earnings. Although dissatisfied with the low base wage rate, the worker upon being employed will always bear in mind the prospects of premium earnings counteracting the low flat wage. After he has been assigned to his job and finds that his premium earnings do not come up to his expectations he will either demand an increase in premium allowance or quit. Almost invariably in the past these demands were granted promiscously in order to keep the worker on the job. If they were not met, the subsequent increase in labor turnover was traceable to the employment man because of the impression he created in the mind of the worker at the time he was employed.

The Employment Man's Troubles

We cannot, however, place the blame on the employment man for this state of affairs. His troubles were plenty when labor was scarce. In many cases his inability to meet competitive bids for labor on the flat hourly basis compelled him to inform the prospective employee of every possibility of increased earnings over the flat wage rate.

The works manager of a certain concern was constantly beset with requests for increased wages. Every morning his desk was stacked with application forms for wage increases submitted to him by various foremen for his approval. To stem the tide, he called all of the foremen and superintendents into consultation and advised them that in the future no increases of the basic wage rates would be made where an employee had opportunities to work premium or piece work. Any increase in earnings of that class of labor would have to be realized by an increase in premium or piece work rates. In fact, where premium rates were established on a basis of the worker's making 25 per cent above his wage rate, instructions were given to assign the rates so that the worker would realize approximately 50 per cent additional earnings.

This had the effect of turning the demands for increased earnings into the channels of the time-study division. Old established premium rates soon became the object of attacks by disgruntled workers. There was no alternative for the time-study men except to increase these premium rates in order to maintain harmony and satisfaction of the workers and at the same time keep within the scope of premium rate adjustments as promulgated by the works manager.

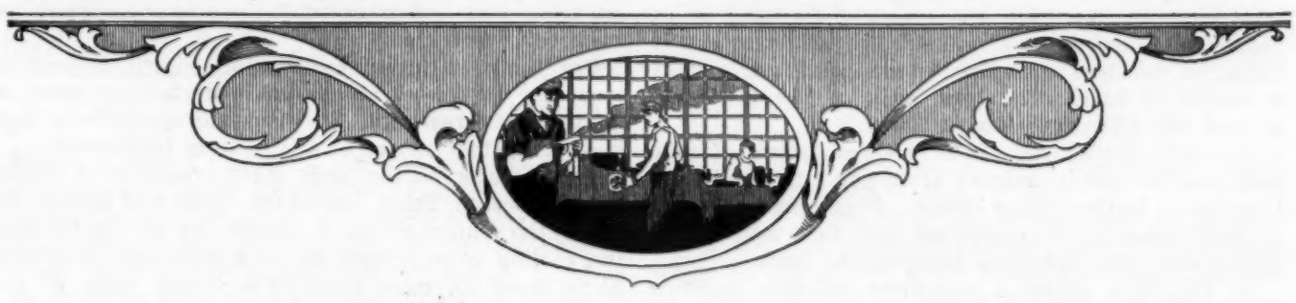
Premium Earnings Must Not Be Used to Control Wage Fluctuations

It is obvious that attempting to use premium earnings as a control of wage fluctuations will directly affect the method by which the employment man engages help. The very moment that such an attempt is made the embryo of a red tape method of wage payment comes into existence.

Fundamentally, it is wrong to establish low wage rates and depend upon the premium system to keep the workers satisfied. When a concern has reached the point where a guaranty of premium earnings must be given in addition to the basic wage rate, it would be far better to discontinue premium work and bring the wage rate up to the approximate unit level of the average combined wage rate and premium earnings of the individual employee.

Overhead would be reduced considerably by the elimination of extra clerks required to calculate the pay roll under the wage-rate-plus-premium method of wage payments. Efficient supervision in the shop should also contribute to further the economy effected by this reduction in overhead, especially in a manufacturing concern which maintains a department masquerading under the title of "Time Study" when as a matter of fact its functions are merely the allocating of rates.

The name of "time study" has been erroneously applied to departments having functions that do not in the least interpret such a title. Such faulty application of the title is a contributary factor in bringing time study into disrepute. For example to call a "rate-setting" department a "time-study" department is fundamentally incorrect because all of the evils arising from rate setting, which may lack the research and analysis of time study, would be placing the blame on time study.



Miscellaneous Operations on the Mack Truck

Special Milling Fixtures and Operations—Centerless Grinding—Using the Thread Comparator—Making Radiators, Cabs and Hoods

By FRED H. COLVIN
Editor, *American Machinist*

SOME of the miscellaneous machining operations in both the Allentown, Pa., and Plainfield, N. J., plants of the International Motor Company are particularly interesting, showing the adaptation of standard machines for special work by the use of ingenious fixtures. A case of this kind is shown on an Ohio tilted milling machine in Fig. 1, where it is necessary to flatten the ends of a large number of steel pins. It was desirable that the bottoms of the cuts be concave instead of convex, as would have been the case had they been arranged on the outside of the circular table and fed past the milling cutter. In order to make them concave, the pins are arranged for milling in groups of four, two being held by each single bolt strap, as this makes the easiest and simplest kind of a fixture to load. The back ends of the pins rest against the adjustable stops shown.

The table holds twelve pins in three groups of four each, and is readily indexed from point to point, and then fed in to the milling cutter. Four pins are milled at each stage of the operation and this method has proved very satisfactory in handling the work.

In Fig. 2 is shown a centerless grinding machine handling piston pins, a particularly interesting feature being the simple form of guides used. The guides are simply hardened steel strips set into the blocks shown, the result being satisfactory both as to output and quality.

The method of testing the water pump casting is shown in Fig. 3. The clamps shown hold the pump casting firmly in place while the pressure is being applied. The pressure regulator shown at *A* insures the proper pressure for each test made. One of the uses made of the Niagara metal-washing machine is shown in Fig. 4. Manifolds and other parts washed in such machines come out thoroughly clean and are ready to go directly to the assembly.

The Hartness thread comparator, Fig. 5, is used in every day shop work and assists materially in securing good screw thread fits. Its surroundings indicate that it is a shop tool instead of a laboratory instrument.

The radiator on the large Mack trucks is of rather peculiar design, being behind the motor and having the fan in the center, so that it throws the air out through the cooling coils instead of in a horizontal direction, as is usual in most cases. The frame work of the

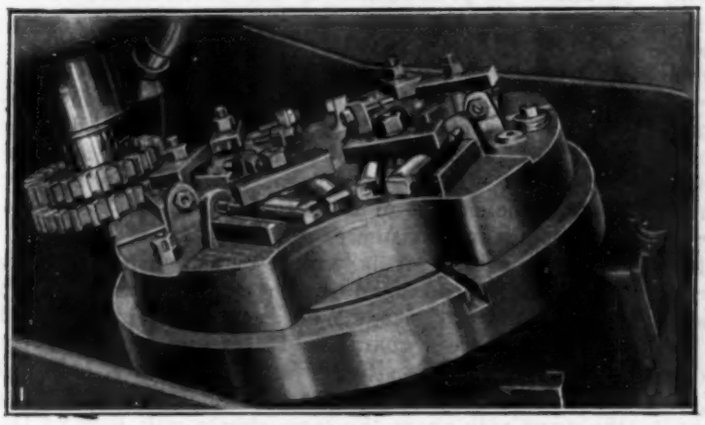


FIG. 1. SPECIAL FIXTURE FOR MILLING STUDS.

FIG. 2. GRINDING PISTON PINS

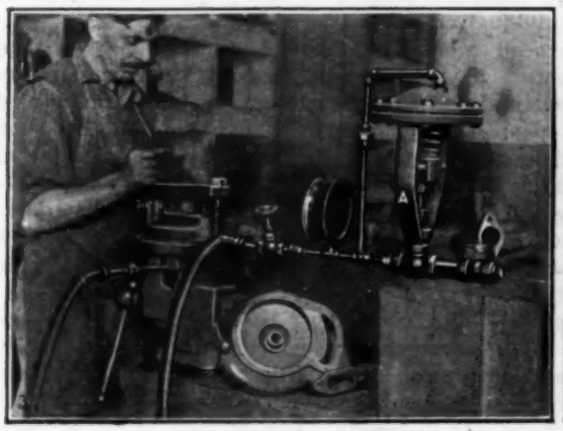


FIG. 3. TESTING WATER PUMP CASES.

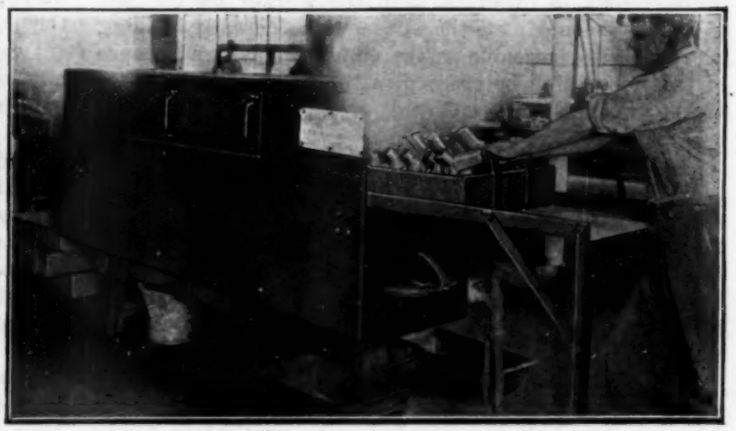


FIG. 4. WASHING PARTS BEFORE ASSEMBLY

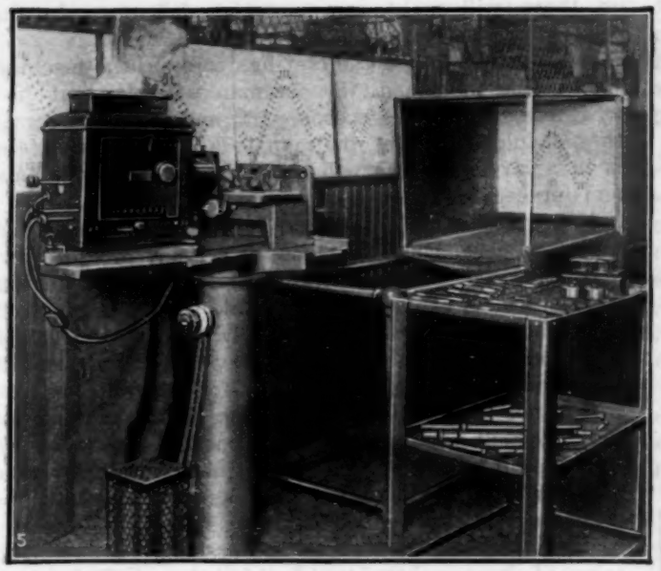
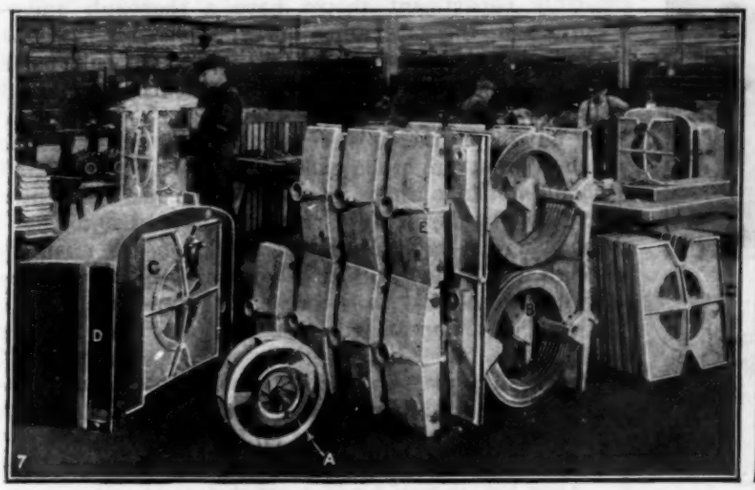


FIG. 5. USING THREAD COMPARATOR IN THE SHOP. FIG. 6. DRILLING RADIATOR FRAME



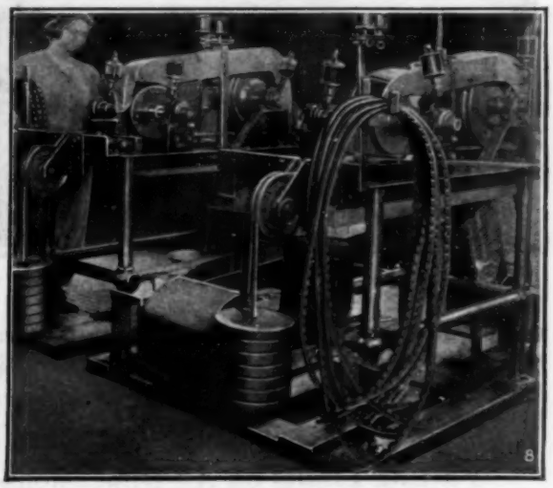
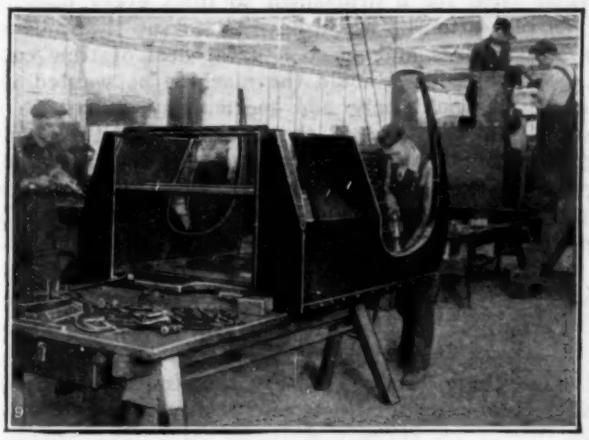


FIG. 7. RADIATOR READY TO ASSEMBLE. FIG. 8. TESTING THE FAN BELTS



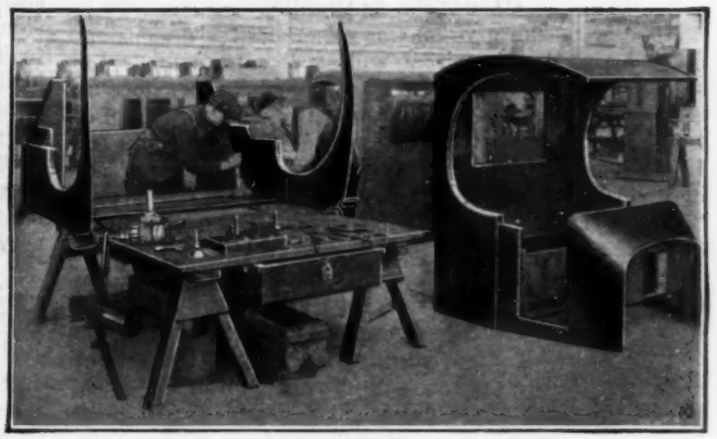


FIG. 9. BUILDING THE CABS. FIG. 10. A COMPLETED CAB

radiator is shown in Fig. 6, together with the drilling fixture, and some of the completed radiators can be seen in Fig. 7. The latter also shows one of the fans at *A*. The fan is mounted inside the circular coils *B*, as may be seen in the assembled radiator at *C*. The side openings in the cowl *D* permit air to escape at each side. The tank for the water supply is an aluminum casting shown at *E*.

Special V-shaped belts are used in driving the fan, and in order to insure satisfaction and prevent slippage while the belt is new, every belt is tested and stretched on the machine shown in Fig. 8. It is run for a given

time under a specified load as supplied by the weight shown. After stretching, it is cut to the proper length so that the user should have very little difficulty even while the belt is new. After testing, the fan belts are carefully wrapped in oiled paper to protect them from moisture.

The driver's cabs are both substantial and comfortable, as can be seen in Figs. 9 and 10. There is considerable work on the cabs as will be noted from the drilling, riveting and bolting up operations shown in the two illustrations. One of the completed open cabs is shown at the right of Fig. 10, and, as may be seen, the door slides back into the side of the cab body. Many cabs are completely enclosed in cold weather so as to afford ample protection for the drivers.

The making of the distinctive Renault hood consists of a number of cutting and forming operations. The final-assembly form is shown in Fig. 11, together with

FIG. 11. A HOOD AND ITS FORM

one of the completed hoods. The form is mounted on a shop truck so as to be at a convenient working height and also to be easily moved anywhere in this department of the shop.

Putting Limits on All Dimensions—Discussion

BY ALFRED T. GREGORY

None of us can give an inflexible rule for dimensioning machine drawings that will serve satisfactorily for all classes of work. Putting limits on dimensions is very practical when carried on with moderation. Beyond the usual practice, however, of making limits for dimensions requiring considerable accuracy, I am not in accord with John Thomas, who wrote the article "Putting Limits on All Dimensions," on page 639 of *American Machinist*.

Let us suppose that a new machine is to be constructed. In some shops a separate set of drawings would be made for the pattern shop, the machine shop and the assembly department. In each of these sets of drawings the draftsman will dimension the drawings to suit the needs of the particular department for which they are intended. In other shops one set of drawings serves all three departments, and the patternmaker must make allowance on his patterns for machining operations.

When the patternmaker receives the drawings and checks them over, is it necessary for him to have limits for his work? He knows how much to allow for certain machining operations. He can tell from the general appearance of the drawings whether $\frac{1}{16}$ in. off here or on there will make any material difference in the casting.

After awhile, when the castings come to the machine shop to be machined, the foreman will plan out just what has to be done to each part, and which machines they should go to for their various operations. If he is in a large shop he will probably call his assistants and job setters and talk it over with them.

It is quite certain that the foreman will know just how each part should be made, as a study of the drawings will give him practically all the information he will need. An experienced mechanic should know about how much to allow for practically all the dimensions that are not limited on the drawings. For instance, if the drawing gives one dimension for a particular part with a note, as driving fit or sliding fit, he knows what to do without any limits. Many times no note is needed to convey information. If he does not quite understand any particular part of the drawings, a talk with the designer will clear up all doubts.

When the work comes to the assembly department, some of it may have to be chiseled and filed, other parts may have to be drilled, etc. The foreman of the assembly department should have a thorough understanding of the mechanism of the machine, so that beyond possibly a few necessary limited dimensions, it would be a waste of time for the draftsman to attempt to put limits on all the dimensions.

In all shops there is a standard of workmanship which is what might be called an unwritten code, and it should not take a new man long to become acquainted with that standard. In large airplane and automobile shops where a high degree of workmanship is maintained, there is always a large force of inspectors whose duty it is to see that these standards are maintained.

It will be apparent from the foregoing that putting limits on all dimensions is unnecessary and impractical from the shop man's point of view. Now a word for the draftsman. Many times a drawing will be so crowded that to add limits to all the dimensions would make it practically impossible for anyone to understand it. Then too, it would add a great deal of unnecessary work to the draftsman's duties. It would take considerable time for a draftsman to limit every dimension, as very often he would have to look up the various tools and fixtures and spend a great deal of time collecting other data. Should the machine be wanted in a hurry, it would only add more delay to its final delivery. In the face of the great competition now existing among manufacturers, and also the way that everyone is trying to cut down expenses, it seems to me that the idea of putting limits on all dimensions is very impractical.

Clear Explanation

BY ROBERT GRIMSHAW

It is one thing—and a good thing, of course—to know a thing thoroughly and accurately. But explaining it to another is an entirely different, and often equally important matter. Showing is sometimes impossible; doing so would necessitate doing the job, instead of having it done, which, where there is no repeat work, would be inadvisable and uneconomical.

The foreman must be able to analyze the job into its main divisions and explain each in sequence to the worker, in terms that the latter can understand and remember.

The Gleason System of Bevel Gears

Quietness in Operation, Strength and Durability Considered — Limiting the Undercut — Preference for Low Pressure Angle—Pressure Causes Wear

BY F. E. McMULLEN AND T. M. DURKAN

FOR a long time need has been felt for a definite system of designing bevel gear teeth, which would give the most desirable tooth form for use under average conditions. It has been common practice in the past to use spur gear formulas, such as those of Brown & Sharpe, in figuring bevels. These formulas were worked out for an interchangeable spur gear system, which necessarily required some compromise. When they were applied to bevel gears, where interchangeability was not a factor, the possibilities of the involute curve were not fully utilized.

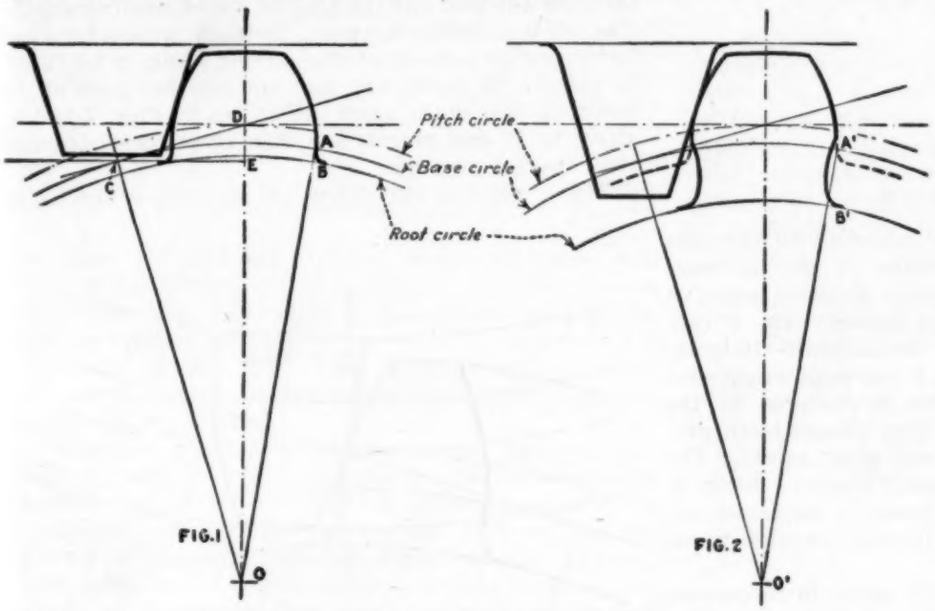


FIG. 1—INVOLUTE TOOTH IN MESH WITH RACK, SHOWING FILLET. FIG. 2—INVOLUTE TOOTH SHOWING UNDERCUT

The Gleason 0.3 and 0.7 long and short addendum tooth was brought out to improve this condition, and various other alterations of the standard spur gear design have been used. For the most part these can be applied to certain combinations only and, therefore, are not universal. Recent applications of bevel gearing covering a wide range of ratios have made it imperative that a progressive system embracing all ratios and any number of teeth in common use, be worked out.

An investigation has been conducted by the Gleason Works to develop a practical system for designing the form of tooth that is consistent with strength and wear considerations, the quietest in operation. The results of this research have been incorporated in the accompanying tables. This system applies to any pair of generated spiral or straight tooth bevel gears operating at right angles where the pinion is the driver and has ten or more teeth. The bevel gears cut on the former-type planers are subjected to a special study as certain practical limitations prevent the application of the system to this class of gearing without modification.

Presented at the spring meeting of the American Gear Manufacturers' Association, April 22 at Buffalo, N. Y.

The principal qualities considered in arriving at this system, arranged in the order of their importance, are quietness in operation, strength and durability. In regard to quietness, experience has shown that bevel gears cut with a lower pressure angle will operate more quietly than those with a higher one, other conditions being equal. There are several reasons which will account for this: With the lower pressure angle a greater arc of action is obtained; any eccentricity has less effect; and the radical component of the tooth load is minimized. Thrust forces also make it desirable to avoid the higher angle, not only because of the introduction of an axial or cone thrust not present in spurs, but also because the majority of bevel gears are overhung from their supports so that the total load should be kept as low as possible. For these reasons the basis of the system is the use of the lowest pressure angle which will not sacrifice strength by introducing an excessive undercut.

It might be well to describe here what is meant by undercut. In Fig. 1 is shown an involute tooth in mesh with a rack. The tooth profile consists of two parts, the involute curve which has its origin at A and continues to the top of the tooth, and the fillet AB lying between the base and root circles. If the rack, which represents the generating tool, does not project below the point C, beyond which involute action cannot take place, the fillet AB will always lie outside of a radial line OA drawn from the origin of the involute.

When the rack tooth is made longer so that it extends below point C, the condition shown in the exaggerated form in Fig. 2 is realized. In this diagram the fillet $A'B'$ lies inside of a radial line $O'A'$ and also slightly cuts away part of the involute curve. An examination of Fig. 1 shows that the value for the dimension DE, which is the distance from C to the pitch line, is equal to the back cone radius $DO \times \sin^2$ pressure angle. From this we might make a definition of undercut by stating that a generated bevel gear tooth is said to be undercut when the dedendum is greater than the back cone radius $\times \sin^2$ pressure angle.

However, it can be shown mathematically that it is possible to exceed this value considerably before there is any appreciable undercut. In fact for the ordinary automobile rear axle pinion having anywhere from ten to thirteen teeth, the dedendum is nearly always more than this critical value, and is sometimes as much as 100 per cent greater. The point at which to limit the

undercut in the present system has been determined by a study of successful automobile practice, because that application represents a condition where both silence in operation and strength are paramount.

The 10-tooth—47-tooth, 14½ deg. spiral bevel ratio

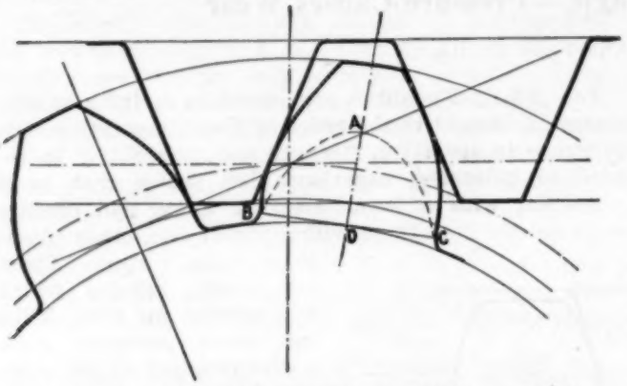


FIG. 3—THE GLEASON SYSTEM 10-TOOTH—47-TOOTH SPIRAL BEVEL RATIO WITH 14½-DEG. PRESSURE ANGLE

shown in Fig. 3 has a pinion dedendum 60 per cent greater than the back cone radius × sin² pressure angle, and although the undercut is about as great as for any tooth form in the spiral bevel system, it cannot be called excessive. Likewise the 14-tooth—16-tooth, 14½ deg. straight bevels in Fig. 4 represent as extreme a case of undercut as will be encountered in the straight tooth system, and yet they have a tooth profile which is not weakened to any great extent. The same ratio with a 17½ deg. pressure angle is shown in Fig. 5 but the strength of the gears is increased less than 5 per cent, although the increase appears to be larger.

The selection of a low pressure angle in preference to a higher one does not result in a considerably weaker tooth, as is ordinarily supposed, for the stronger section of the higher pressure angle tooth is offset by the greater arc of action with the lower angle. Reference to Figs. 3 and 6 will make this clear.

In Fig. 3 a 10-tooth—47-tooth ratio drawn with a

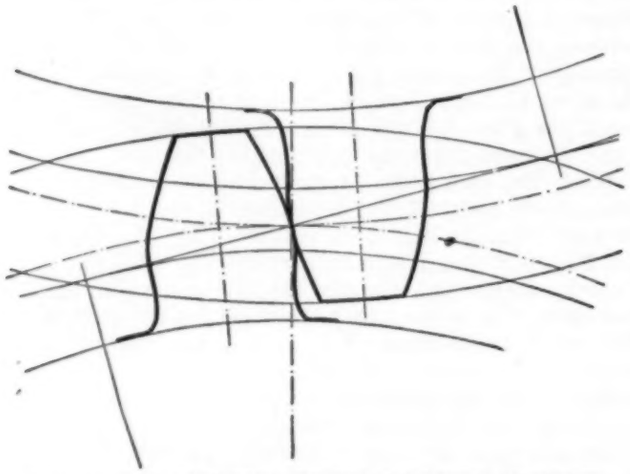


FIG. 4—THE GLEASON SYSTEM 14-TOOTH—16-TOOTH STRAIGHT BEVEL RATIO WITH 14½-DEG. PRESSURE ANGLE

14½ deg. pressure angle is shown and in Fig. 6 the same ratio is laid out with a 20 degree pressure angle. In each case the pinion tooth at the left is just on the point of engaging so that the tooth at the right is carrying the full load. This will be the worst condition of loading on each tooth as any further movement to the right brings another tooth into contact with consequent distribution of the load over two teeth, while movement to the left lowers the line of application of the force toward the base of the tooth. In this position the comparative strength of the teeth can be found by passing a parabola through the intersection, point *A* (see Figs. 3 and 6) of the line of action and center line of tooth, and tangent to the tooth profile. The value of $(BC)^3 \div AD$, which is a measure of the strength can then be obtained.

For the 10-tooth—47-tooth ratios shown in Figs. 3 and 6 the 20 deg. gear is about 14 per cent stronger than the 14½ deg. but the pinions are of equal strength. The 20 deg. ratio, however, is much worse for case hardening on account of the narrow width of top land. A pair of 15 tooth, 14½ deg. and another pair of 15 tooth, 20 deg. miter gears are shown in Figs. 7 and 8. Here the 20 deg. gear is less than 10 per cent stronger than the 14½ deg. gear.

This method of calculating the strength is similar to

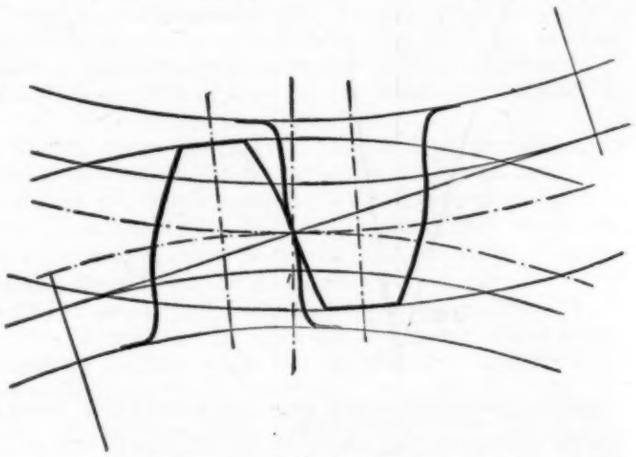


FIG. 5—A 14-TOOTH—16-TOOTH STRAIGHT BEVEL RATIO WITH 17½-DEG. PRESSURE ANGLE

the one used in deriving the Lewis formula, except in regard to the point of application of the load. The Lewis formula is based on the assumption that the load is applied at the end of the tooth, but in modern generating gearing this is a condition which practically never occurs. Prof. Marx in his experiments at Leland Stamford University, found that the force was not at the end of the tooth when failure took place, and also proved that the strength was increased as the arc of action became greater. From a consideration of these conditions, it is evident that the choice of a 14½ deg. instead of a 20 deg. pressure angle is not made at any extreme sacrifice of strength, but that for a large number of designs there is very little difference between the two.

The question of durability viewed from a theoretical standpoint would seem to resolve itself into a problem of obtaining a minimum of sliding and a maximum of rolling motion, as it is natural to assume that the wear would vary directly with the sliding action. But it is well known that the greatest wear often takes place near the pitch point where there is no sliding action. This is because the big factor causing wear is unit pressure and not sliding action. When the point of contact is near the pitch point all the load is borne by one tooth, while it is distributed over two teeth near the

beginning or end of action with a consequent reduction of unit pressure.

In Figs. 7 and 8 that part of the pinion profile which will wear most rapidly is *FG*, because it is forced to carry the whole load. On account of the lower unit

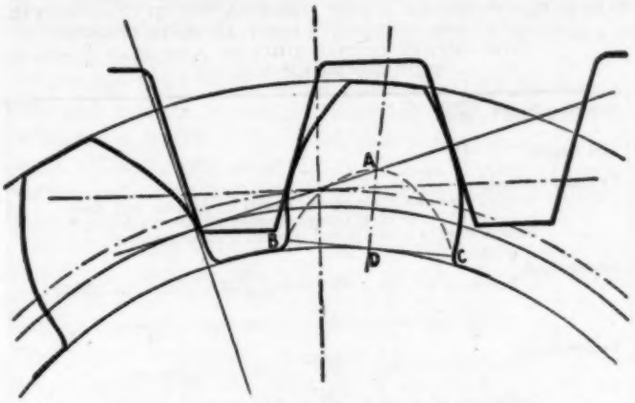


FIG. 6—A 10-TOOTH—47-TOOTH SPIRAL BEVEL RATIO WITH 20-DEG. PRESSURE ANGLE

pressure *EF* and *GH* will not wear as quickly even though the sliding action is higher. For this reason no attempt has been made in this system to maintain any predetermined percentage of rolling action but rather to balance up between approach and recess the amount of rolling already fixed by the requirements of quietness and strength.

Wherever possible, the action during approach has been favored in order to compensate for the change in direction of the friction component which tends to increase the obliquity of the line of action during approach and decrease it during recess. Account has also been taken of the high velocity of sliding action which occurs at the top of long addendum pinion teeth and which, in extreme cases, has led to abrasion. Safe values for this sliding action were obtained from jobs in service and the design was regulated so that these were not exceeded.

In establishing the various factors which go to make up the system, the aim was to arrange them in as simple and practicable a form as possible without sacrificing any of the three principal qualities of quiet-

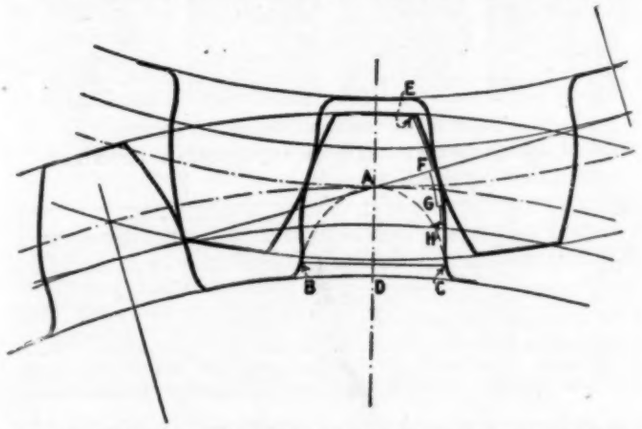


FIG. 7—THE GLEASON SYSTEM 15-TOOTH SPIRAL BEVEL MITER WITH 14½-DEG. PRESSURE ANGLE

ness, strength and durability. In a non-interchangeable system like the one here presented, any of the factors can be made to vary for each ratio and number of teeth. However, simplicity and the interests of standardization are opposed to expressing these factors as variable quantities where the probable accuracy of the assumptions made in determining them does not warrant it. An example of this is the pressure angle.

In a purely theoretical system the pressure angle might have any value. However, the same practical results are obtained in this system, which includes all ratios having ten or more teeth in the pinion, with the use of three angles of 14½, 17½ and 20 deg. for straight tooth bevels and of one angle of 14½ deg. for spiral bevels in all except a few unusual cases.

The pressure angle to be used for any given pair of gears is specified in Tables I and III, and has been selected as the lowest angle which avoids excessive undercut. The introduction of the pressure angle of 17½ deg., which is not universally used, is considered necessary in order to live up to the stated purpose of developing a practical system which will give the quietest form of tooth consistent with strength and wear.

It has been found by experience that there is a decided increase in noise when the pressure angle is changed from 14½ deg. to 20 deg., so that in order not to compromise the system when the undercut becomes

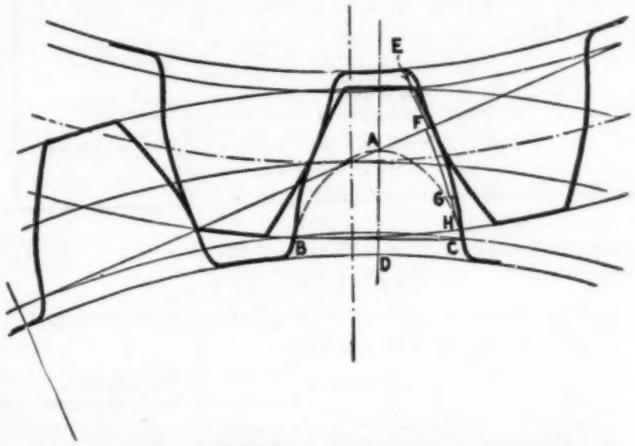


FIG. 8—A 15-TOOTH SPIRAL BEVEL MITER WITH 20-DEG. PRESSURE ANGLE

too great with 14½ deg., an intermediate pressure angle must be called for. The angle of 17½ deg. has been selected because it has already been used to quite an extent by different gear manufacturers. Although at least one pressure angle between 14½ deg. and 20 deg., which are 5½ deg. apart, is required, more are unnecessary. Any new angle would not differ by more than 1½ deg. from the three selected angles of 14½, 17½ and 20 deg. This change is too small to have any practical effect.

The working depth of tooth, which has been fixed as 2.000 in. ÷ D.P. for straight tooth bevels and 1.700 in. ÷ D. P. for spirals, has been successfully used for a number of years. For the average spiral angle of about 30 deg., the normal pitch is approximately 85 per cent of the linear so the normal section of a spiral tooth will have about the same proportion as a straight tooth.

Originally the working depth for both straight and spiral bevels was made to equal 2.000 in. ÷ D.P., but some years ago the depth for spiral bevels was decreased to 85 per cent of this amount because the top of the tooth on the normal was too thin and gave rise to hardening troubles. Stubbing the tooth more than 85 per cent decreased the arc of action and gave a noisier gear.

It would be desirable from a standpoint of standardization to use the same working depth for straight tooth bevels as for spirals, but after considerable experimenting along this line, it was found that straight bevels

TABLE I—FORMULAS FOR GENERATED STRAIGHT TOOTH BEVEL GEARS, OPERATING AT RIGHT-ANGLES WHERE THE PINION IS THE DRIVER AND HAS TEN OR MORE TEETH

Working Depth $\frac{2.000"}{D.P.}$

Full Depth $\frac{2.188"}{D.P.}$

Pressure Angle

Ratios having 14 or more teeth in pinion ..... 14½ deg.
Ratios 13-13 to 13-24-17½ deg. Ratios 13-25 and higher 14½ "
Ratios 12-12 and higher ..... 17½ "
Ratios 11-11 to 11-14-20 deg. Ratios 11-15 and higher 17½ "
Ratios 10-10 and higher ..... 20 "

Addendum

Addendum of gear = $\frac{\text{addendum for 1 D.P. (from table)}}{D.P.}$

Addendum of pinion = $\frac{2.000"}{D.P.}$ − addendum of gear

Dedendum

Dedendum of gear = $\frac{2.188"}{D.P.}$ − addendum of gear

Dedendum of pinion = $\frac{2.188"}{D.P.}$ − addendum of pinion

Circular Thickness

Circular thickness of gear for all ratios using 14½ deg.
$= \frac{1.071"}{D.P.} + (0.5 \times \text{addendum of gear}) - \frac{K}{D.P.}$ (from table)

Circular thickness of gear for all ratios using 17½ deg.
$= \frac{0.971"}{D.P.} + (0.6 \times \text{addendum of gear}) - \frac{K}{D.P.}$ (from table)

Circular thickness of gear for all ratios using 20 deg.
$\frac{0.871"}{D.P.} + (0.7 \times \text{addendum of gear}) - \frac{K}{D.P.}$ (from table)

Circular thickness of pinion for 14½ deg, 17½ deg, or 20 deg.
$= \frac{3.142"}{D.P.}$ − circular thickness of gear

TABLE II—VALUES FOR STRAIGHT TOOTH BEVEL GEARS

ADDENDA FOR 1 D.P.

To obtain addendum select from table value corresponding to ratio given by this formula:—

$$\text{Ratio} = \frac{\text{Number of teeth in gear}}{\text{Number of teeth in pinion}}$$

Ratios From	Ratios To	Add.
1.00	1.00	1.000
1.00	1.02	.990
1.02	1.03	.980
1.03	1.04	.970
1.04	1.05	.960
1.05	1.06	.950
1.06	1.08	.940
1.08	1.09	.930
1.09	1.11	.920
1.11	1.12	.910
1.12	1.14	.900
1.14	1.15	.890
1.15	1.17	.880
1.17	1.19	.870
1.19	1.21	.860
1.21	1.23	.850
1.23	1.25	.840
1.25	1.27	.830
1.27	1.29	.820
1.29	1.31	.810
1.31	1.33	.800
1.33	1.36	.790
1.36	1.39	.780
1.39	1.42	.770
1.42	1.45	.760
1.45	1.48	.750
1.48	1.52	.740
1.52	1.56	.730
1.56	1.60	.720
1.60	1.65	.710
1.65	1.70	.700
1.70	1.76	.690
1.76	1.82	.680
1.82	1.89	.670
1.89	1.97	.660
1.97	2.06	.650
2.06	2.16	.640
2.16	2.27	.630
2.27	2.41	.620
2.41	2.58	.610
2.58	2.78	.600
2.78	3.05	.590
3.05	3.41	.580
3.41	3.94	.570
3.94	4.62	.560
4.62	6.61	.550
6.61	∞	.540

VALUES OF K FOR CIRCULAR THICKNESS FORMULA

Select value corresponding to number of teeth in pinion and ratio given by above formula.

Number of teeth in pinion	Ratios →	Values of K for different ratios. 1.00 to 1.25	1.25 to 1.50	1.50 to 1.75	1.75 to 2.00	2.00 to 2.25	2.25 to 2.50	2.50 to 2.75	2.75 to 3.00	3.00 to 3.25	3.25 to 3.50	3.50 to 3.75	3.75 to 4.00	4.00 to 4.50	4.50 to 5.00	5.00 and higher
10		.025	.070	.100	.120	.140	.160	.175	.190	.205	.215	.225	.230	.240	.250	.250
11		.010	.015	.050	.080	.105	.125	.145	.160	.170	.180	.190	.195	.200	.210	.220
12		.000	.040	.070	.100	.120	.140	.135	.170	.180	.185	.190	.195	.205	.210	.215
13		.000	.015	.040	.045	.050	.060	.070	.060	.090	.100	.110	.120	.135	.150	.165
14		.000	.015	.030	.050	.065	.080	.090	.100	.110	.120	.125	.150	.140	.150	.160
15 to 17		.000	.000	.010	.020	.030	.045	.060	.070	.080	.090	.095	.100	.110	.115	.120
18 to 21		.000	.000	.000	.000	.010	.020	.045	.060	.070	.080	.085	.090	.095	.100	.100
22 to 29		.000	.000	.000	.000	.010	.020	.040	.050	.060	.065	.070	.080	.080	.085	.085
30 and up		.000	.000	.000	.000	.010	.025	.035	.040	.045	.050	.055	.060	.065	.070	.070

having an 85 per cent stub tooth were noticeably noisier in running than similar gears with the full depth tooth. Consequently, the standard of $\frac{2.000}{D.P.}$ in. has been retained for straight tooth bevels.

The bottom clearance specified in the system is $\frac{0.188}{D.P.}$ in. (which is 0.06 × circular pitch). This is the minimum amount which experience shows is necessary for the average job to insure against any bottoming of the teeth. In the past, 0.05 × circular pitch was used and

TABLE III—FORMULAS FOR GENERATED SPIRAL BEVEL GEARS OPERATING AT RIGHT-ANGLES WHERE THE PINION IS THE DRIVER AND HAS TEN OR MORE TEETH

Working Depth $\frac{1.700"}{D.P.}$

Full Depth $\frac{1.888"}{D.P.}$

Pressure Angle

Ratios having 12 or more teeth in pinion 14½ deg.
Ratios 11-11 to 11-19-17½ deg. Ratios 11-20 and higher 14½ deg
Ratios 10-10 to 10-24-17½ deg. Ratios 10-25 and higher 14½ deg

Addendum

Addendum of gear = $\frac{\text{addendum for 1 D.P. (from table)}}{D.P.}$

Addendum of pinion = $\frac{1.700"}{D.P.}$ − addendum of gear

Dedendum

Dedendum of gear = $\frac{1.888"}{D.P.}$ − addendum of gear

Dedendum of pinion = $\frac{1.888"}{D.P.}$ − addendum of pinion

Circular Thickness

Circular thickness of gear for all ratios using 14½ deg.
$= \frac{1.061"}{D.P.} + (0.6 \times \text{addendum of gear}) - \frac{K}{D.P.}$ (from table)

Circular thickness of gear for all ratios using 17½ deg.
$= \frac{0.976"}{D.P.} + (0.7 \times \text{addendum of gear}) - \frac{K}{D.P.}$ (from table)

Circular thickness of pinion for 14½ deg. or 17½ deg
$= \frac{3.142}{D.P.}$ − circular thickness of gear

was found to be insufficient, while 0.07 × circular pitch which was also tried out was more than required.

The method followed in proportioning the addendum

TABLE IV—VALUES FOR SPIRAL BEVEL GEARS

ADDENDA FOR 1 D.P.

To obtain addendum select from table value corresponding to ratio given by this formula:

$$\text{Ratio} = \frac{\text{Number of teeth in gear}}{\text{Number of teeth in pinion}}$$

Ratios From	Ratios To	Add.
1.00	1.00	.850
1.00	1.02	.840
1.02	1.05	.830
1.05	1.05	.820
1.05	1.06	.810
1.06	1.08	.800
1.08	1.09	.790
1.09	1.11	.780
1.11	1.13	.770
1.13	1.15	.760
1.15	1.17	.750
1.17	1.19	.740
1.19	1.21	.730
1.21	1.23	.720
1.23	1.26	.710
1.26	1.28	.700
1.28	1.31	.690
1.31	1.34	.680
1.34	1.37	.670
1.37	1.41	.660
1.41	1.44	.650
1.44	1.48	.640
1.48	1.52	.630
1.52	1.57	.620
1.57	1.63	.610
1.63	1.68	.600
1.68	1.75	.590
1.75	1.82	.580
1.82	1.90	.570
1.90	1.99	.560
1.99	2.10	.550
2.10	2.23	.540
2.23	2.38	.530
2.38	2.56	.520
2.56	2.82	.510
2.82	3.17	.500
3.17	3.67	.490
3.67	4.56	.480
4.56	7.00	.470
7.00	∞	.460

VALUES OF K FOR CIRCULAR THICKNESS FORMULA

Select value corresponding to number of teeth in pinion and ratio given by above formula.

Number of teeth in pinion	Ratios →	Values of K for different ratios. 1.00 to 1.25	1.25 to 1.50	1.50 to 1.75	1.75 to 2.00	2.00 to 2.25	2.25 to 2.50	2.50 to 2.75	2.75 to 3.00	3.00 to 3.25	3.25 to 3.50	3.50 to 3.75	3.75 to 4.00	4.00 to 4.50	4.50 to 5.00	5.00 and higher
10		.020	.055	.085	.105	.125	.125	.110	.120	.130	.140	.150	.155	.160	.170	.180
11		.030	.075	.105	.070	.085	.095	.105	.115	.125	.135	.140	.145	.150	.155	.160
12 to 13		.005	.015	.025	.035	.045	.055	.065	.075	.085	.095	.105	.115	.125	.135	.135
14 to 16		.000	.005	.015	.025	.035	.050	.060	.075	.085	.095	.100	.105	.105	.105	.105
17 to 19		.000	.000	.005	.015	.025	.035	.050	.065	.075	.085	.090	.090	.090	.090	.090
20 and up		.000	.000	.000	.005	.015	.025	.040	.050	.055	.060	.060	.060	.060	.060	.060

and dedendum was to adjust them until the amount of sliding during approach was about the same or slightly less than the sliding action during recess. This also had the effect of making the arc of recess greater than the arc of approach, which is very desirable, since the recess action is quieter than that of the approach. To obtain these conditions it was necessary to decrease the gear addendum and increase the pinion addendum

as the ratios of the numbers of teeth in the gear and pinion became greater. These values of addendums for gear and pinion were originally worked out for each ratio and number of teeth, and from an examination of them it was found possible to make an arrangement in a simple tabular form according to the ratios as shown in Tables II and IV, without any sacrifice of practical qualities.

Circular thicknesses were found entirely by making enlarged layouts in which the teeth were balanced up partly on a width of top land and partly on a strength basis. The formulas given in Tables I and III were worked out so that they would give the same results as were obtained from the layouts.

In conclusion it can be said that this system is not something new or untried but, in the case of spiral bevels at least, it is represented in practice by a large number of very satisfactory jobs. It also checks up closely with successful straight tooth bevel gear practice although the long and short addendum tooth has not been used as universally for straight tooth bevels as for spirals. The system, as presented, represents in a simple and usable form an intensive study of the question of bevel gear tooth design, treated from both a practical and theoretical standpoint.

It might not be out of place here to express the opinion that a standard non-interchangeable system is needed for spur gears, possibly along similar lines to the one just presented. In fact such a system should be of as great importance as a standard interchangeable system since a large proportion of spur gears, like bevels, are intended to operate in pairs only. The concessions made to allow interchangeability are so great that the case of the non-interchangeable gear should be granted as much consideration for a standard system as is given to the interchangeable gear.

Romances of Metal Working—
The Sagas of Volund and His Sword

By H. H. Manchester

One of the most famous series of Norse Sagas has to do with Volund, the smith, and his magic sword, Gram.

Volund and his two brothers were famous smiths in the days of the early gods. As they kept the smithy ringing with their blows, they accompanied them with this song:

"Tick, tack, tock, tick, tack, tay,
Hey, merry comrades, hammer away:
When the iron's hot and the sparks do fly,
Something comes of it by and by."

Nothing was too wonderful for them to forge. One of Volund's masterpieces was a marvelous sword, Gram, of which he had learned the secret among the black dwarfs, who forged the sword of Freyer. He forged and broke it over and over many times until it had such a temper that it could not be broken by mortal strength. The edge itself he tempered with elf powder and dragon's blood until it would cut through anything.

Not long after the sword was made the brothers saw three beautiful Valkyries bathing, with their white wings laid aside on the beach. Seizing the wings they persuaded the maidens to remain and be their wives. This endured for seven years, during which period Volund forged numberless precious ornaments for his wife, Alvit, or All White. At the end of this time the Valkyries took their wings and flew away, but in the meantime Volund had learned to forge wings with which he could fly.

The other brothers went in search of their wives, but Volund remained, because All White had left him a magic ring which he had made, to which she must sooner or later return.

While asleep, Volund was overpowered by King Nidud, of Sweden, and carried away into slavery together with all his treasures. The sinews of his legs were cut, and he was set to work forging marvelous ornaments and weapons for the king. In the meantime, however, he stealthily forged himself wings like those of the Valkyries.

Not long afterward the king brought in his magic sword, Gram, to be refurbished. Volund secretly fashioned a duplicate of it and gave it to the king instead. Then in revenge he killed the two younger children of the king, made love successfully to the king's daughter, and putting on his wings, and taking his sword and the ring for All White, mounted the top of the castle, and after taunting the king with what he had done, flew away to find his wife.

The subsequent fortunes of this sword run all the way through the story of the Nibilungens and Wagner's operas, and were even said to have been traced down to our own country.

Odin, the king of the Norse gods, gave this sword to Sigmund, who used it to revenge the murder of his family by Siggeir and the Goths.

When Sigmund's time had come, Odin himself had to appear on the battle field and break the sword before Sigmund could be defeated. His young wife, however, gathered up the pieces of the sword and carried them with her to another kingdom.

When Sigmund's son, Sigurd, was a young man, Regin, another smith, urged him to go against Fafnir, a dragon who guarded a great treasure. For this purpose Regin forged one sword after another, but Sigurd broke them with ease. He then thought of the pieces of his father's sword which had been saved by his mother. He brought them out, and they were welded together by Regin. To try this weapon Sigurd struck it upon the anvil, and was amazed to see that it cleft the iron anvil from top to bottom. With it he slew Fafnir the dragon and obtained the treasure.

After this Sigurd, who appears in Wagner's opera as Siegfried, journeyed to awake Brunhild the beautiful Valkyrie, who had been condemned to sleep until a man without fear should rescue her. Her castle was entirely surrounded by flames, but the sword cut through them as easily as it did through iron. Later Sigurd was enchanted by Grimhild, queen of the Nibilungens, and married her daughter Gudrun, aiding her son Gunar to gain Brunhild as his wife. This brought about a situation which could only end in tragedy.

The sword descended to Attila and accounted for his victories. The legend runs that it later came into the possession of Charles IX of Sweden, then of Peter the Great of Russia, then Gustavus Adolphus of Sweden, and finally Frederick the Great. In each case it was supposed to have made its possessor, though he did not know it, unconquerable while he held it. It was even reported that it was sent by Frederick the Great to Washington with the message: "From the world's oldest to its greatest general," and in later years Congress actually purchased one of the swords left by Washington on the assumption, which was perhaps mistaken, that it had been sent to him by Frederick the Great.

Automotive Service Methods and Equipment

XI. Simplicity and Efficiency in Service Tools—Facing Valves—A Connecting-rod Fixture—Lapping Cylinder Bores

By HOWARD CAMPBELL
Western Editor, *American Machinist*

IT IS frequently found that the efficiency of a tool increases in proportion to the simplicity of its construction and the ease with which it is operated. The equipment of the service plant of the Chicago distributors for the Studebaker Corporation includes a number of tools that would come under this classification, some of which are described herewith.

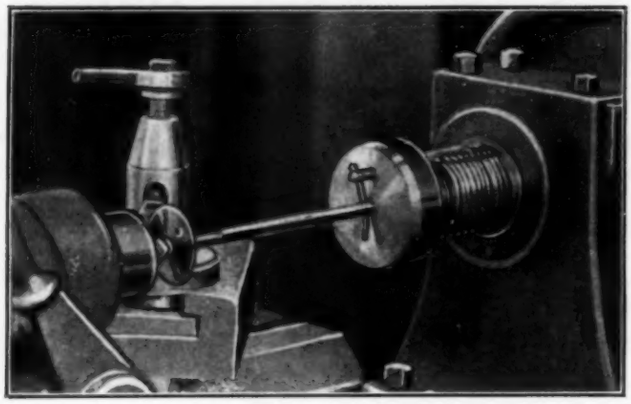
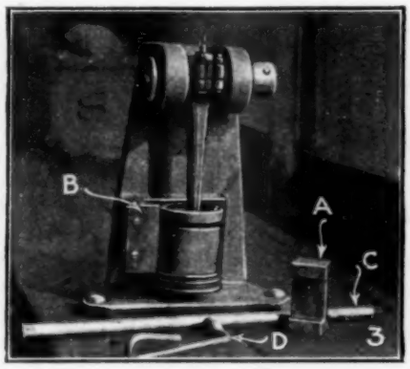


FIG. 1. FIXTURE FOR VALVE FACING

In Fig. 1 is shown a fixture for holding and driving a valve while the seat is being faced. The necessity for such a fixture arises from the fact that the end of the valve stem is centerless. The fixture is made of cast iron and has a taper shank turned on the back side, which makes it possible to hold it in the spindle of the lathe. A central hole is drilled in the face, to receive the end of the valve stem, as shown. A steel pin $\frac{1}{8}$ in. in diameter is driven or screwed into the face of the fixture, about $1\frac{1}{2}$ in. from the center, which serves to drive a pin inserted in the hole in the valve stem, thus turning the valve with the spindle.

The method of testing a connecting rod for straightness is shown in Fig. 2. The shaft by which the large end of the rod is held in the fixture is of the same diameter as the crankshaft. A finished surface can be seen at *A*, against which the operator is holding the steel block shown at *A* in Fig. 3. A pin that has been ground to a push fit in the wristpin hole is inserted in the hole and aligned with the ends of the block. The center of the block has been milled out so that the rod will not interfere. If there is any twist in the rod, it can be instantly detected.



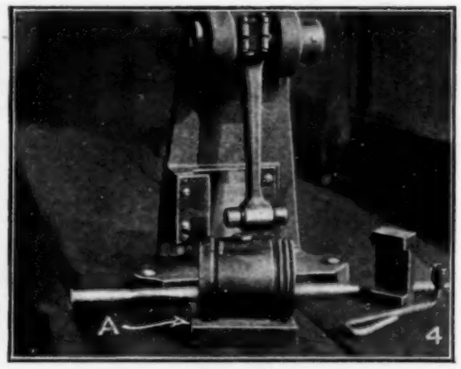


FIG. 2. TESTING A CONNECTING ROD FOR TWIST. FIG. 3. TESTING A CONNECTING ROD FOR STRAIGHTNESS
FIG. 4. TESTING WRISTPIN HOLE FOR SQUARENESS

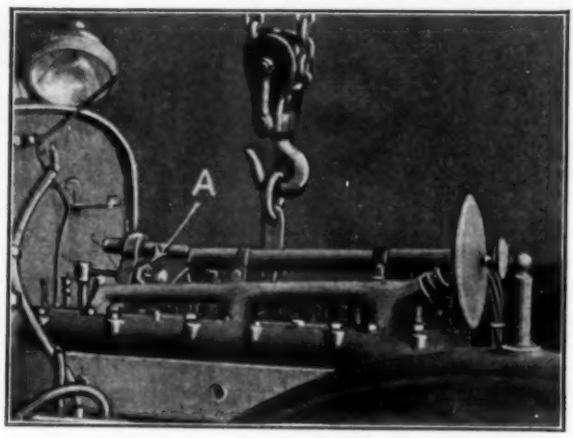


FIG. 5. METHOD OF HANDLING MOTORS

A piston is now assembled to the rod and aligned with the steel block shown at *B* in Fig. 3. If the rod is bent or twisted, the small end of the bar *C* is inserted in the wristpin hole and the rod is straightened. The wrench shown at *D* is used to tighten the bearing cap bolts.

In case there is any doubt as to whether the wristpin hole is square with the axis of the piston, it is tested on the gage shown at *A* in Fig. 4. This gage consists of a steel block with a plane surface, in the center of which is a pin of the proper diameter for a running fit in the wristpin hole. The piston is placed on this pin and if the hole is not square with the axis, it can be instantly detected by the light that will shine through under one end of the piston.

A very common method of handling motors is to screw an eye-bolt into one of the spark plug holes and then hook into the eye-bolt with a chain block. This throws the weight of the motor entirely on to the

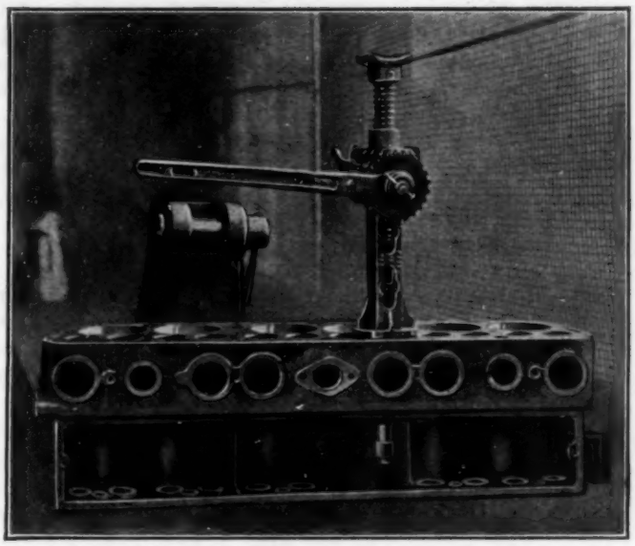


FIG. 6. VALVE GUIDE ASSEMBLING TOOL

threads of one hole. In this plant, however, a method has been devised whereby the weight of the motor is distributed over four holes, greatly reducing the possibility of damage to any one of them. Eyebolts are screwed into each of the four holes, two at each end of the motor, and each pair of holes is connected by a small shaft, as shown at *A* in Fig. 5. These small shafts are then attached to a larger shaft as shown, the larger shaft being in turn pinned through the center to a block into which a ring has been forged.

A tool for assembling valve guides to a cylinder block is illustrated in Fig. 6. This is nothing more nor less than an ordinary jack which has been converted to this use by the simple process of attaching a rod to the bottom end of the screw. The rod is small enough to slide through the valve stem hole in the valve guide, and long enough so that when the tool is set on the top of a cylinder, the rod will extend down through the cylinder far enough to allow a valve guide to be placed on the rod with room for a nut to be screwed on the end to hold the guide. The simple operation of "raising" the jack, by operating the handle up and down, then draws the valve guide into the hole. This tool has an advantage over some of the tools that have been placed on the market for this purpose, in that it pulls the guide straight in without the necessity of the rod's turning in the guide. The rod is attached to the screw by threading one end and screwing it into a tapped hole in the bottom end of the screw.

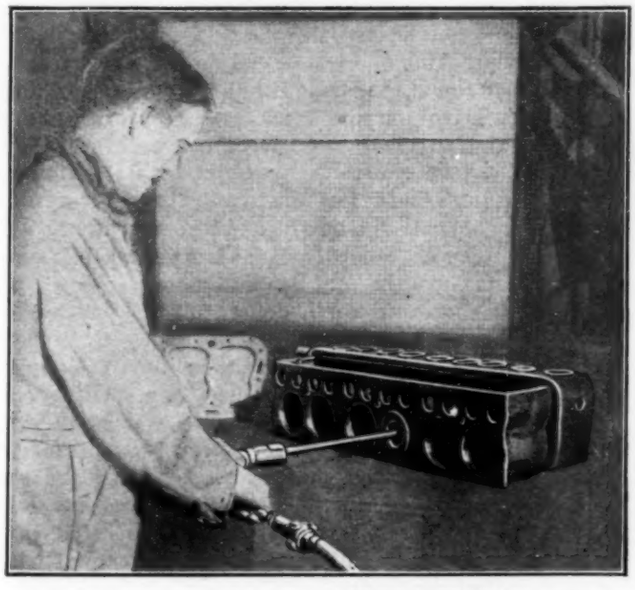


FIG. 7. POLISHING A CYLINDER BORE

The operator shown in Fig. 7 is polishing a cylinder bore with a wooden piston which has been covered with abrasive cloth. The piston is held by a pin through an eye in the end of the shaft and the tool is being operated by means of an electric drill. The grade of abrasive cloth used is varied according to the amount of polishing necessary, a coarse grade being used at first if much polishing is to be done, and crocus cloth being used to finish the operation. This method is frequently employed to make a bore the same diameter throughout its entire length, in cases where the piston has worn the cylinder larger at one end than at the other.

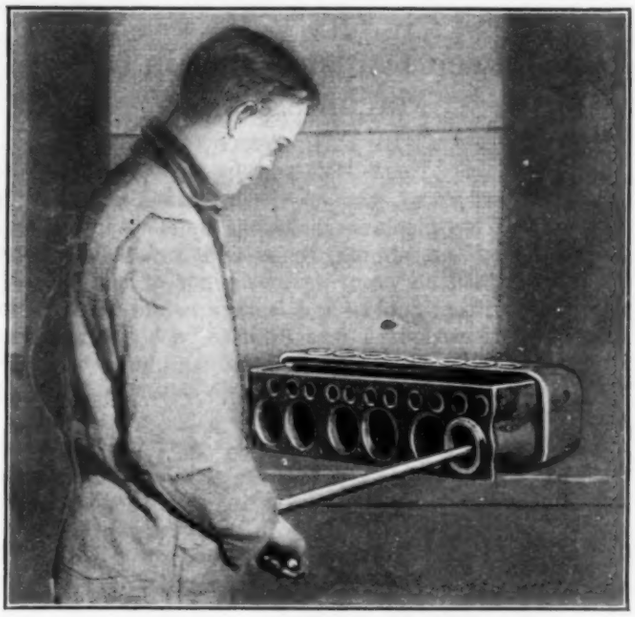


FIG. 8. LAPPING-IN A PISTON

FIG. 9. TESTING AN AXLE FOR STRAIGHTNESS

After the high spots have been polished out of the

cylinder bore, it may be necessary to lap the piston "in" so that it will be an easy sliding fit. A T-handle is used for this operation, an eye in the end of the shaft allowing the piston to be attached by means of a wrist-pin. Abrasive and oil are used to lap the bore until the piston will slide easily. This tool is shown in Fig. 8.

One form of gage used to test an axle for straightness is illustrated in Fig. 9. That part of the gage indicated at *A* is a straight bar that extends clear across and rests on the rim of the opposite wheel. When the shoulder *B* is resting against the side of the rim, the point *C* should just touch the side of the rim at its highest point. If there is a gap between the side of the rim and either the shoulder or the point, the wheel is not vertical. The point *C* is adjustable, but is never moved after being set even with the shoulder.

Power Transmission in the Machine Shop

By F. P. Terry
Belfast, Ireland

A few days ago I was asked why it is that in about nine out of ten machine shops one finds wobbling pulleys and shafting, slipping belts and occasionally belts made up of odd pieces of various kinds of belting such as balata, cotton, rubber and leather, while in nine out of ten textile works the opposite is to be found, shafting bright and true, pulleys painted and running true, bearings clean and with neat drip pans to collect any oil that may escape the bearings.

I had to admit that there was a good deal of truth in what my friend said, but to explain the cause is difficult unless we put it down to sheer neglect. We cannot say ignorance because in many cases the worst offenders are the very firms who have started up with the beautiful arrangements referred to and found in the textile mills.

One important factor is that very often line shafting and the care of it is in the charge of a millwright department that is quite content so long as things keep moving, and the machine shop foreman finds his complaints neglected or ignored altogether, with perhaps a gentle reminder to "mind his own business."

The purchasing of belting is frequently entirely in the hands of a buyer or purchasing agent, who buys entirely on price because it is the only thing he knows about. Usually the machine shop foreman can, as a special concession, specify the type of belting to buy, but whether it is leather, balata or any other kind he has to put up with the cheapest obtainable.

The above conditions are a moderate representation of what existed in a shop that I took charge of a few years ago, and, after tackling some of the most pressing problems directly affecting the output, I began to look at the things above. This brought me up against the foreman millwright whose principal argument was that things had been all right for the last twenty years and he was for leaving well enough alone; but after a good deal of noise about the noise above, I got a millwright under my own charge who also took charge of machine tool repairs. My next trouble was with the purchase of belting, which proved a difficult matter, because the buyer was on the office staff and not so easy to get at; also because of the fact that there is no definite standard in belting as in other furnishings. Even the best manufacturers make two or three grades and the purchasing agent who buys on price can always be accommodated, and in my opinion is very much to blame for the many types of poor belting manufactured today. In my case the belting used was the poorest quality imaginable and was no sooner on the pulleys than it developed the proverbial "dog's hind leg" shape. I remember well the starting up of a Landis universal grinding machine, the last place in the world on which to put a belt of this variety. It was a case of a different belt or sending the machine back to the makers. I also gave a personally conducted tour round a few more belts that were busy slap banging the belt forks as their main object in life. This resulted in the selection and purchase of all belting for my own use passing into my hands. Everything now appeared to be smooth sailing, but I very soon discovered I had a great deal to learn and I was greatly surprised at the amount of power lost and the excessive wear of bearings that can accrue from shafting that is out of line or not properly supported by bearings.

Regarding belting, I got many surprises. I read all I could find about it in back numbers of the American Machinist and other journals and found that if one wanted to get a certain speed from a driven pulley, belt thickness had to be calculated with the pulley diameters and the substitution of different thicknesses of belt changed the speeds; that badly twisted leather belting could be coiled tightly on a wood mandrel, placed in a chuck and faced up, after which, although reduced in width, it would do considerable service. I also found that running leather belts in the right direction with the lap joints made a very great difference to the life of the joints and that leather belting made of pieces over 4 ft. 6 in. long could be consigned to the class known as second-rate. In my own case I returned any over this length to the makers.

Up to this time I had no faith in any belting other than leather, but studying the subject I found that for motor drives where the motors are placed on side rails and free from belt forks, endless balata belts are hard to beat and are also easy to make; an intelligent beltman after one lesson can do the job satisfactorily. I also found that wide thin belts were preferable in most cases to narrow thick ones, and that belts subject to sudden reversal on machines such as turret lathes had a very short life when reversal took place from the countershaft, but that turret lathes reversed from the headstock did not have the same affect.

These and many other little matters kept me very busy for some months, but I was content in my own mind that the job was worth doing. At the end of the first year I was brought on the carpet by the buyer to explain why I had expended nearly two hundred pounds more in belting than ever had been spent in one year before, but very little explanation was necessary, in fact, before the end of another year I was asked to take over control of the shafting and belting for the whole works, which I did to the satisfaction of everyone concerned, more particularly myself, as I felt that in this one item, so often neglected in many shops, I was earning my salary.

Methods of Machine Tool Design

Beginning Fourth Section on Belting and Belting Applications—Belting Specifications, Elementary Principles, Kinds—Round Belts, Crossed and Quarter-turn Belts

BY A. L. DELEEUW

IT IS not the intention in these chapters to repeat statements or to give information which may be found in many standard works existing at the present day. Nevertheless, it will be necessary to point out some of the most important features of some of the elements used in machine-tool construction and to discuss their advantages and disadvantages.

Considering belts and belt drives we should look at them, in the first place, as means for power transmission and then note the limitations of such arrangements when applied to machine tools. There are single,

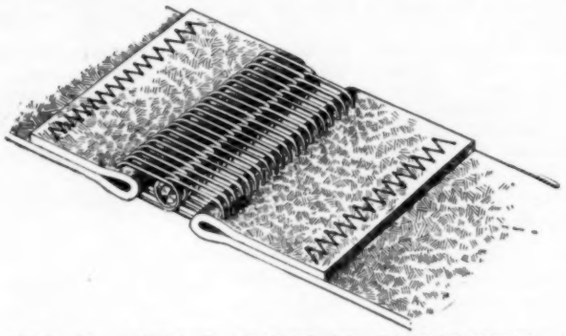


FIG. 31. METHOD OF JOINING CANVAS BELT

double and triple belts. The belts we are most familiar with are made of oak-tanned leather. The very fact that we are so familiar with this class of belts is a disadvantage because we naturally take for granted that this kind must be used in all cases where a belt is applied to a machine tool.

However, there are other kinds which have marked advantages in certain cases. For instance, though in the majority of machine-tool drives the oak-tanned leather is perhaps the best, in cases like planer drives where the belt must repeatedly pick up a load and start it in a very short period of time from a condition of rest to a condition of full speed oak-tanned leather is not the best for the purpose. The unavoidable slippage in this case has a tendency to burn the surface in contact with the pulley. In such cases chrome leather should be used, notwithstanding that it is not quite as strong as oak-tanned leather.

There are many cases in the heavier machine tools where it is not advisable to use a very wide belt and yet where we must provide sufficient strength of belt to transmit a large amount of power. This could be done by using a triple or even a quadruple belt, but in doing so we would need very large pulleys on account of the great thickness. In such cases a belt made up of leather and hard rawhide should be used. The rawhide is cemented between two layers of oak-tanned leather and is much thinner than either layer. As the unyielding layer of rawhide is in the center, it does not materially affect the flexibility of the belt, but it adds very much to its strength. The strength of this rawhide is 20,000 lb. per square inch section as compared to 5,000 lb. for oak-tanned belt. Where belts have to transmit a large amount of power, and at the same time may have to withstand a great amount of slippage, chrome leather with rawhide in the center meets the condition. There are cases where a chrome leather belt, though properly meeting the condition of slippage, is not quite strong enough for the purpose. In such cases a double belt is made up of one layer (the one next to the pulley) of chrome leather and an outside layer of oak-tanned leather.

There are cases where rubber belts, and others where camel's hair or fabric belts, give the best service. However, as such cases are exceedingly rare in machine-tool drives we will confine ourselves to the statement that rubber belts give good satisfaction where a great deal of cast-iron dust is present in the atmosphere, which is very apt to neutralize the grease in a leather belt. Camel's hair belting is particularly adapted to moist and hot places, and it is but seldom that machine tools are found in such locations.

Canvas belting, especially of the endless variety, is used for light and high-speed drives, such as for spindles of internal grinding machines. In such cases the belt should be impregnated with some gum or other substance which will produce an adhesive surface. Canvas belting has also been used for the drive of very light machinery and gives good satisfaction. It stretches little or not at all and consequently does not

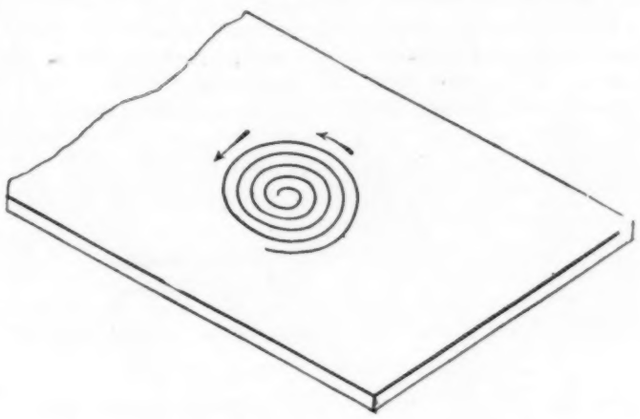


FIG. 32. METHOD OF CUTTING SPIRAL STRIP FOR ROUND BELTING

require to be taken up. Its chief drawback is that there is no good belt fastener in existence which meets the requirements of canvas belts, and that either the two ends of the belt must be stitched together in position or else the two loose ends must be turned over before a metallic fastener is introduced. This has the tendency to cause a thick portion in the belt where the joint is made. (See Fig. 31.) The loose flaps *A* and *A* are apt to cause trouble, and for that reason should be stitched to the main portion of the

For the author's forthcoming book. All rights reserved.

belt, as shown in the illustration. There is no reason why canvas belts should be recommended except on account of their cheapness, and whether such belts are

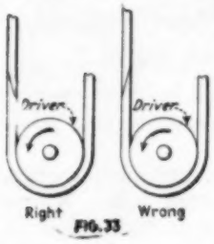


FIG. 33. RIGHT AND WRONG WAY OF APPLYING BELT.
FIG. 34. CROSSED BELT

actually cheaper in the long run remains yet to be established.

Practically all belts are flat, but now and then a round belt is used. Such belts are only useful where the work is very light. Due to the way they are made, round belts lack uniformity. The strips of leather which are cemented together to make a flat belt are always cut lengthwise of the hide, or rather, center (that portion of the hide which should be used for belting). These strips do not all have the same qualities. Strength, stretch, flexibility, and adhesive quality vary with the distance of the strip from the center of the hide (line of backbone), and there is even a certain lack of uniformity in different parts of one strip, depending on whether that part is near the shoulder or near the tail. However, these differences are not excessive and, in any case, cannot be avoided.

On the other hand, a round belt is usually cut by going around the leather (center) in a spiral. (See Fig. 32.) Thus some parts of the belt are lengthwise and other parts crosswise of the hide. This causes a great lack of uniformity, making the crosswise parts very weak. As a result, a round belt stretches unduly and cannot be heavily loaded.

When three or more round belts are twisted together they are more reliable, but cause some trouble in making a proper joint or fastening. Such a belt may be useful when there is not sufficient room for a flat belt; the *grip* of a round belt in a V-rimmed pulley being much greater than that of a flat belt. As a whole, round belts should be avoided except for the very lightest kind of work.

Putting the belt in the machine is not the work of the designer, but as the machine is often blamed when the belt is at fault, it is right that we should mention those things which may cause trouble with an

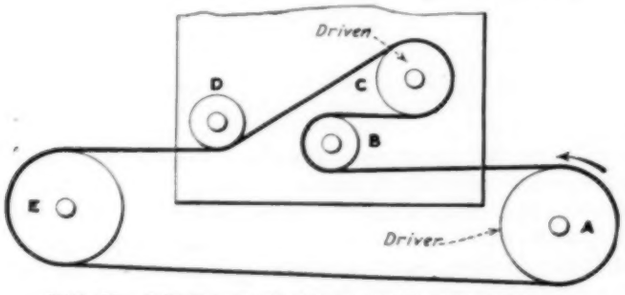


FIG. 35. BELT DRIVE WITH IDLE END PULLEY

otherwise well-designed machine. Among them are some qualities of the belt and also the manner of its installation.

After exhaustive research and many tests, the U. S. Steel Corporation has recently issued a set of specifications for oak-tanned leather belting, of which we give an extract. Many other points, besides those given here, are mentioned, but the fulfillment of these requirements can only be ascertained at the belt factory, while the points mentioned here can be examined at the factory of the user.

It is possible to treat a belt so as to increase its strength or reduce its stretch, or increase its flexibility or its adhesive qualities, but it is not possible to do all of these things at the same time; so that when limits are given for all of these qualities and a belt meets them all, it may be assumed that it will be of the desired quality.

E TRACT OF BELT SPECIFICITIONS

The thickness of a belt must not vary more than $\frac{3}{64}$ inch from the thinnest to the thickest portion of the belt.

The width of belt, 8 in. or less, must not vary more than $\frac{1}{16}$ in. Belts over 8 in. in width must be within $\frac{1}{8}$ inch.

The tensile strength of single belt must not be less than 700 lb. and for double belt not less than 1,400 lb. per inch of width.

The elongation shall be not less than fourteen per cent nor more than twenty-eight per cent at breaking load.

Laps must not be less than 3 in. long and must have a tensile strength of not less than 700 lb. per inch width for single and 1,400 lb. for double belt.

Animal oils or greases, only, shall be used for stuffing. The total stuffing must not be less than 8 per cent.

Other tests are prescribed, requiring apparatus not often found in the machine shop.

Of all questions asked about belting, no one is more common than this: Which side of the belt should be on the pulley? The flesh side appears to be much rougher than the hair side, and many people are inclined to think that this roughness will give better traction. As a matter of fact, the opposite is true. It is just because a rough surface gives little traction that a belt should be tested for so-called piping. Piping is the name for the wrinkles which appear on the surface of an inferior belt when it is sharply bent, and which do not entirely disappear when the belt is again straightened out. Not only does this piping diminish the traction but, because of this reduced tractive power, there is an additional amount of slippage which is apt to burn out the surface of the belt. As the hair side is the smoother, it should be placed on the pulley. A little thought would have answered the question even for one who does not know anything about belts. The fact that the beltmaker makes double belts with the hair side out on both sides shows that he intended the user to put the hair side on the pulley.

Belts are made of relatively short strips of leather, the length varying somewhat according to the length of the hide from which they are cut. They are seldom less than 45 in. or more than 54 in. long. The joints are made by tapering the leather down to a feather edge and cementing the two bevels together under pressure. However well such a lap or joint may be made there is danger of opening it up if we lay the belt flat on a table and push a block against the edge of the lap. This same danger exists when the belt is put on the pulley the wrong way. Fig. 33 shows the right and the wrong way of putting a belt on the pulley, so far as the laps are concerned. It might seem at first glance as if a crossed belt cannot lie right on both pulleys, but Fig. 34 shows that when it is laid properly for one pulley it must necessarily be right for the other.

The speed at which belting may be run and the horsepower it can transmit have been subjects for a great deal of controversy and are not yet entirely settled. As with all matters of engineering, different viewpoints may be held under different conditions. The writer has seen belts run at a speed of 7,500 ft. per minute and under a tension very much in excess of what is ordinarily considered good practice. Though under these conditions the belt did not have a long life, yet it was the best that could be done under the circumstances. Until quite recently, belt speeds higher than 3,000 ft. per minute were considered excessive. Nowadays speeds of 4,000 to 4,500 ft. per minute are considered permissible.

As to the allowable tension, from 40 to 45 lb. per inch width is good practice for single belts, and from 60 to 75 lb. for double belts. Much higher tensions are used but are not advisable for machine tools which are often called upon to perform a duty very much in excess of their rated capacity. If we mill a piece of steel with an average cut of $\frac{1}{8}$ in. deep and we should meet a lump $\frac{1}{4}$ in. high, suddenly increasing the cut 200 per cent, we expect the belt t pull this cut, and for that reason it is necessary to figure on a relatively low tension when the machine is performing according to its rated capacity. Whenever possible a belt should be run horizontally with the slack side on top. The most unfavorable condition presents itself when we are compelled to run the belt vertically with the driving pulley at the top. The initial tension is reduced by the weight of the belt. Not only that, but when the machine is running one side will be stretched while the other side will be relaxed, so that the belt contact with the lower pulley is only a fraction of the theoretical amount. If we should not be able to run the belt horizontally, we should at least try to get as much horizontal distance as possible between machine and countershaft centers, and to have the slack side of the belt run at the top.

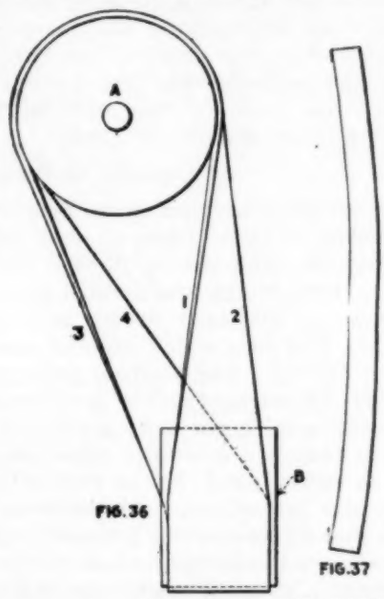


FIG. 36. QUARTER-TURN BELT WITH BAD FEATURE EXAGGERATED. FIG. 37. BOWED BELT FOR QUARTER TURN

A belt shows two kinds of stretch. That part of the belt which is under tension will stretch but the belt will resume its original length as soon as the tension is released; in other words, the belt shows elasticity. However, when a belt is run for a considerable period of time, and especially when it is new, it will gradually become longer and this lengthening of the belt is not a temporary affair but a permanent one. As a result of this permanent stretch, the initial tension of a belt gradually diminishes and it needs to be taken up. There are various ways in which this take up can be arranged for. In ordinary practice a piece is taken out of the belt, after which it is relaced. Where metallic belt fasteners are used, of the type of the Peerless lace, the following method for taking up belts in a factory is recommended:

All belts are made of two pieces—a long and a short piece. The short piece is about 8 to 10 in. in length. The millwright keeps in stock various pieces or patches of belt of lengths of 8—7½—7—6½—6 in., etc. When a belt with an 8-in. patch has become too long, he removes the rawhide pin, takes out a patch and substitutes another one, ½ in. shorter, or perhaps 1 in. shorter.

Where endless belts are used, or where metallic belt fasteners are not permissible, a belt tightener may be employed. Such a tightener can be arranged in various ways, such, for instance, as a pulley on a swinging arm pressing against the outside of the belt by means of a weight or spring, or which can be positively pushed up against the belt by means of slide rails and a screw. A peculiar use was made of such belt tighteners in the Mitchell planer drive, of which more later on.

We naturally visualize a belt drive as having a pulley at each end, one of them being the driver and the other the driven one. However, there are drives in which one of the end pulleys is really an idler. Such a drive is represented in Fig. 35, in which pulley *A* is the driver. Pulleys *B*, *C* and *D* belong to the machine and pulley *E* is an idler. Such an arrangement may be found, for instance, where the column of a floor boring or a milling machine moves along a bed and the mechanism on that column must be driven from the stationary pulley *A*. In such an arrangement either pulley *E* or *B* may be used for the take up.

The use of open and crossed belts is too well known to be discussed here in a general way. However, attention is called to the necessity of having a long center distance between the pulleys when using crossed belt. Preferably, the center distance should not be less than four times the mean diameter of the pulleys. For instance, two pulleys 24 and 16 in. in diameter, connected by a crossed belt, should have a center distance of not less than $4 \times \frac{24 + 16}{2} = 80$ in. This rule should not be considered as a law, but rather as a warning.

A very narrow belt could get along with a shorter distance; a wide belt might require a longer one. The main thing is to avoid appreciable twist where the driving and slack stretches of the belt pass each other. Unless this is taken care of there will be rubbing, with consequent excessive wear, and a tendency to open up the edges.

Crossed and Quarter-Turn Belts

Belts are crossed for two reasons: To give the driven pulley the proper direction, or to obtain a sufficient amount of belt contact when the pulleys differ much in diameter and their center-distance is short. As was mentioned before, crossed belts on short center-distances are not desirable, so that wherever possible the problem of providing belt contact should be solved some other way.

Quarter-turn belts should be avoided as much as possible. They are a source of trouble and the amount of trouble increases rapidly with increasing belt width and decreasing center-distance. The main sources of trouble are the lack of sufficient belt contact on the pulleys, and the fact that the two edges of the belt are

stretched unevenly. If we should measure the two edges of the belt after it has been placed around the pulleys, we would find that they are of unequal length.

In Fig. 36 a quarter-turn belt is shown with the objectionable conditions much exaggerated. The edges Nos. 1 and 2 of the belt are evidently of the same length, and just as clearly edges Nos. 3 and 4 must be of different lengths. It follows then, that in order to have the same tension in front and rear edges of the belt, we should make these edges of different lengths; in other words, the belt should be bowed as shown in Fig. 37. This is sometimes done, but a careful look at Fig. 36 will show that the problem cannot be solved that way. If the belt is made as in Fig. 37 the edges Nos. 1 and 2 will be under different tensions, so that we have merely displaced our trouble. However, it is possible to diminish the amount of this trouble somewhat in this manner. The proper way to overcome it as much as possible is to make the center-distance large and guide the belt by idler pulleys.

(Continued in next week's issue.)

How Surface Affects Measurement With Plug and Ring Gages

By Frank C. Hudson

One old shop conundrum, on which thousands of cubic feet of vocalized air (heated and otherwise), has been expended, has been answered. Can a 2-in. plug be inserted in a 2-in. ring? Yes—and then some—to the tune of about a half thousandth.

It seems foolish of course, even to intimate that a hardened plug measuring 2 in. can be put in a hardened ring measuring 1.995 in. without a sledge hammer or an arbor press. But after you watch John Bath, of Worcester, Mass., show you what can be done with bare hands you cannot help wondering just what we have been doing with plugs and gages during the past twenty years. One thing is certain, however, you see beyond question that the condition of the surface being measured affects the apparent size as indicated by a plug and ring.

Take a ring and a plug which will barely enter when dry. Clean them both carefully. Bath has found a little soap and water the best. Wipe them perfectly dry. Put on a little castor oil, or other good oil, well distributed and see how easily the plug slips into the ring. It will probably slide down of its own weight.

Wipe off the oil each side of the ring, and clean it thoroughly, move the ring and repeat the cleaning. When you get it clean the ring is liable to stay right where it is unless you use force. And yet we naturally assume that the oil film occupies some space.

Now take a 2-in. plug and a ring with the hole about a half-thousandth small. Oil them both well and see if you can't push them together without undue pressure. Why? Does the ring stretch or the plug compress? Isn't it one or the other? And what is its bearing on inspecting work with plug and ring gages?

The fact that there is a distinct difference between the apparent diameter with the surface dry or oiled, shows that the condition of the surface does make a difference. Even breathing on the perfectly dry surface makes a little difference. Knowing this, isn't it reasonable to question the accuracy we think we are getting with plug and ring gages? Isn't it especially necessary to have the surfaces of pieces being inspected in an exactly similar condition to compare them?

The Passing of a Pioneer

AN APPRECIATION OF THE WORK OF WILLIAM GLEASON

It is to be regretted that with the passing of William Gleason, founder of the Gleason Works, Rochester, N. Y., we have lost one of the last of the pioneers in the machine-tool business of this country. Away back in 1865 William Gleason founded the nucleus of what has grown to be the Gleason Works, with its extensive buildings and its world-wide reputation.

Born in Tipperary, Ireland, in 1836, William Gleason came to this country in 1851, at the age of 15, and started to work for Asa R. Swift, of Rochester. His apprenticeship was served there and in the shop of I. Angell & Sons. During the Civil War he went to Colt's Armory in Hartford, Conn., but went back to Rochester in 1865 and formed a partnership with John Connel and James S. Graham to manufacture machine tools and woodworking machinery. The fact that this partnership was dissolved in 1873 and that William Gleason perfected his first bevel gear planer in that year, has made us lose sight of his earlier achievements in the machine-tool field.

Change of Firm

With the dissolving of the firm of Connel, Gleason & Graham, William Gleason went with the Kidd Iron Works in 1873, taking it over two years later. The Kidd Iron Works was located down in the old power section of Rochester known as Brown's Race because of the mill race which supplied power to the shops in this vicinity. The business grew steadily, all energies being concentrated on the development of machines for cutting bevel gears more accurately and more economically than had ever been done before. Additions were made to the plant, but in 1910 it became necessary to abandon the old site and the plant was moved out to the present location on University Avenue. Great care was given to the architecture of the buildings and they present a pleasing appearance without being ornate or garish in any way. They may still be considered as models of modern shop buildings.

Phenomenal Growth of the Business

The growth of the shop from one of six men to a plant occupying twenty acres and employing 1,700 men during the rush of work during the war was very gratifying to its founder, but he liked to talk of the days when he built lathes and planers, some of which are still in operation. The memories of his older achievements, however, did not prevent his being keenly interested in the development of the Gleason gear planer. This machine which was almost entirely developed by his two sons James E. and Andrew Gleason has a world-wide reputation for the production of accurate bevel gears.

Active almost to the last, William Gleason never lost touch with his older employees, a few of whom had been with him for over 45 years. And during an illness, about a year ago when business was very bad, he was anxious lest some of the older and most deserving men should suffer in any way. Always genial, always fair in his dealings, he will long be remembered as a shining light in the machine-tool industry. He leaves a widow by a second marriage, two sons, James E. and Andrew, and two daughters Kate and Eleanor.

Decimal Series for Tap Drills

BY A. J. SCHWARTZ

A firm manufacturing large quantities of screw thread products for the U. S. Government, found it impossible to obtain commercial size drills that would be entirely satisfactory for use in drilling all the holes to be tapped in accordance with the report of the National Screw Thread Commission, even though advantage had been taken of the permitted tolerance. This firm had to resort to special drills, or to boring some of the holes in order to meet the requirements of the limits of tolerance specified in the report, as the law authorizing the commission made it mandatory upon the U. S. Government to use the uniform screw thread products made in agreement with the report of the commission.

PROPOSED TABLE OF DECIMAL TAP DRILLS FOR CLASS II-B MEDIUM FIT THREADS

Coarse Thread Series						Fine Thread Series					
Size	Thds.	Tapped Hole Minor Diam. Min.	Tapped Hole Minor Diam. Max.	Drill Size	Stock Drills	Size	Thds.	Tapped Hole Minor Diam. Min.	Tapped Hole Minor Diam. Max.	Drill Size	Stock Drills
0	..	.....	.....	.....	.....	0	80	0.0465	0.0478	0.047	1.2mm.
1	64	0.0561	0.0578	0.057	.....	1	72	0.0580	0.0595	0.059	1.5mm.
2	56	0.0667	0.0686	0.067	.....	2	64	0.0691	0.0708	0.070	No. 50
3	48	0.0764	0.0787	0.077	5/64	3	56	0.0797	0.0816	0.080	No. 46
4	40	0.0849	0.0876	0.085	2.2mm.	4	48	0.0894	0.0917	0.090	.....
5	40	0.0979	0.1006	0.100	No. 39	5	44	0.1004	0.1029	0.102	2.6mm.
6	32	0.1042	0.1076	0.105	2.7mm.	6	40	0.1109	0.1136	0.113	No. 33
8	32	0.1302	0.1336	0.130	.....	8	36	0.1339	0.1369	0.135	No. 29
10	24	0.1449	0.1494	0.145	3.75mm.	10	32	0.1562	0.1596	0.159	No. 21
12	24	0.1709	0.1754	0.170	4.4mm.	12	28	0.1773	0.1812	0.180	No. 15
1/4	20	0.1959	0.2013	0.200	No. 8	1/4	28	0.2113	0.2152	0.215	No. 3
5/16	18	0.2524	0.2584	0.255	6.5mm.	5/16	24	0.2674	0.2719	0.270	.....
3/8	16	0.2073	0.3141	0.310	7.9mm.	3/8	24	0.3299	0.3314	0.330	No. Q
7/16	14	0.3602	0.3679	0.365	9.25mm.	7/16	20	0.3834	0.3888	0.385	No. W
1/2	13	0.4167	0.4251	0.420	11/32	1/2	20	0.4459	0.4513	0.450	.....
9/16	12	0.4723	0.4813	0.480	.....	9/16	18	0.5024	0.5083	0.505	.....
5/8	11	0.5266	0.5364	0.530	13.5mm.	5/8	18	0.5649	0.5709	0.570	.....
11/16	10	0.6417	0.6526	0.650	.....	11/16	16	0.6823	0.6891	0.685	11/16
3/4	9	0.7547	0.7667	0.760	.....	3/4	14	0.7977	0.8054	0.800	.....
1.0	8	0.8647	0.8782	0.875	7/8	1.0	14	0.9227	0.9304	0.925	.....
1 1/8	7	0.9704	0.9858	0.980	.....	1 1/8	12	1.0348	1.0438	1.040	.....
1 1/4	7	1.0954	1.1108	1.100	28mm.	1 1/4	12	1.1598	1.1688	1.165	.....
1 3/8	6	1.3196	1.3376	1.330	1 11/32	1 3/8	12	1.4098	1.4188	1.415	.....
1 1/2	5	1.5335	1.5551	1.550	.....	1 1/2	12	1.6598	1.6688	1.665	.....
2	4 1/2	1.7594	1.7835	1.780	45mm.	2	12	1.9098	1.9188	1.915	.....

In order that there may be a uniformity in drill sizes, the plea is made for a new system or series of tap drills that will be suitable for the minimum diameter of the hole given in the tables of the report of the commission. We already have established the following systems for drills, viz., numbered sizes and letter sizes, the actual diameter of which are not known offhand, nor can be remembered by the average mechanic. Then we have the fractional system of drills, which when the size is in 64ths, is just about as vague to the same class of mechanics. While during the World War we adopted the millimeter series, that series requires interpretation if conversion is made to decimals. Decimal drills are made and kept in stock by some firms, but these sizes are as a general rule ordered as specials.

If all the foregoing sizes were arranged in a table according to a decimal series, it would show that drill manufacturers are obliged to carry in stock over 550 different so called standard drills, from No. 0 to 3½ in. varying in some instances between sizes by only 0.0002, 0,0003 and 0.0004 in. These differences correspond to toolmaker's gage tolerance, and it is thought that such sizes should not be required from drill manufacturers. There are carried in stock by some firms, as many as fifteen sizes of commercial drills between 0.75 and 0.875 inch.

An appeal is made to designers and draftsmen to adopt a table of sizes of the different drill series and, preferably, adopt the decimal size series so that the number and letter series will gradually be forgotten and the great quantity of sizes reduced to a minimum, thereby permitting the jobber to keep in stock a complete set of one standard drill for tapped holes. Of course, we will always have with us the metric and fractional series, and some day it is the hope that they will be superseded by the standard uniform decimal series. The accompanying table is submitted for a three decimal-size drill series, to be used for the screw thread products specified in the report of the commission. These sizes have not, however, been given a practical test.

It will be noted that some of the drill sizes exceed the recommended working-gage tolerance, but the sizes are all within the tolerance specified in the report, and at the same time, there is ample tolerance and allowance for wear permitted for the manufacture of the drills. The commission report having adopted the minimum hole as standard, reduces the system to the use of only one series of forty-nine drills for both its coarse and fine screw threads. As the minimum hole is expressed in decimals, the drill series should also be expressed in decimals. These drills should be marked with the normal size of the screw, the threads per inch and the nominal size of the drill. Each set of drills to be labeled "National Standard Screw-Thread Tap Drills." These sets to be made up in three units: (1) Drills for 1⅛ to 3 in. inclusive; (2) 1 to ¼ in. and (3) Nos. 12 to 0.

The drill manufacturers may substitute some of their present stocks of standard drills for the sizes given in the table, if the drills fall within the tolerance of the tapped hole, but the drills should be marked as noted above. The sizes of the drills do not vary by a uniform constant, but it will be noticed that with the exception of the first few sizes, the decimal size drills end in a zero or a five.

A little investigation will show that there is a very large amount of money expended for broken drills and taps and spoiled work, due solely to the lack of knowledge regarding drill and tap performances on the part of all concerned. The investigation of drill sizes for screw thread work is very urgently needed at the present time, and in particular the standardization of drill sizes for the National Screw Thread System for both the coarse and fine thread series. To quote from a paragraph given in an advertisement of a large drill manufacturer "The National Screw Thread System is a development of the manufacturing hell arising during the World War, and at that time the obvious lack of standardization in thread tolerance resulted in untold delay, grief, misunderstanding and tremendous expense." Our present knowledge regarding the drill question is about in the same condition as it was of screw threads during the World War. A practical investigation should be made as to the drill sizes to be used for the holes recommended by the commission, as chance and haphazard methods used in drilling are very expensive propositions.

It is well known that accurately drilled holes insure more perfect threads and consequently make the parts fit better and closer when screwed together, thus assuring rigidity and reliability; and that a complete knowledge on the use of drills to get the most out of them and the confidence in such knowledge that the drills used are cutting within the prescribed accuracy, will greatly increase production and with a corresponding decrease in the cost.

Ideas from Practical Men

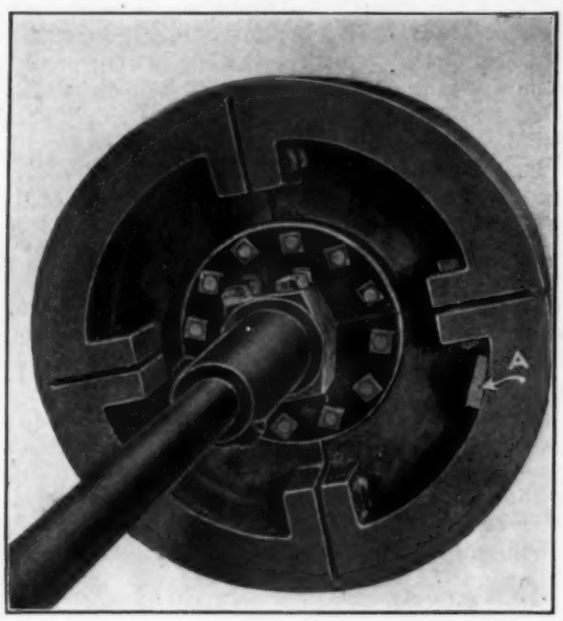
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Building a Flywheel Under Difficulties

BY R. GRANT

We had occasion to make a flywheel of about 3,000 lb. weight, 3 ft. in diameter and with a rim 13 in. wide by 4 in. thick. As our largest turning equipment was a 16-in. Hendey lathe we were somewhat handicapped, and were obliged to resort to building up the wheel as shown in the cut.

The hubs and flanges, made in halves, were as large



FLYWHEEL BUILT BY HAND

as the lathe would swing and were completed by the usual machining operations. A pattern was made to cast the rim in quarter sections and our machine equipment allowed us to drill all the bolt holes by power, but this was the extent of the machine work possible on the web and rim.

With the rim sections bolted together, a seat was made on one side of the web for the flange by chipping, using a surface gage and checking to the rim to get this face true. To chip the opposite side of the web the wheel was laid on one of the hubs so that the surface of the web already chipped rested on the finished face of the hub. The hub was held centrally by pins in the bolt holes. A short shaft was placed through the hub and web and the second hub put on the projecting end of the shaft. The finished face of this second hub was used as a surface plate to indicate the truth of the chipping as the work progressed.

Notwithstanding the crude method of producing it, the completed wheel needed only a small block, shown at *A*, to balance it.

Hooks for Handling Locomotive Tires

BY J. ROBERT PHELPS

The illustrations herewith show a pair of hooks used in the Atchison, Topeka & Santa Fe shops at San Bernardino, Cal., for handling locomotive tires. In

FIG. 1. THE TIRE HOOKS

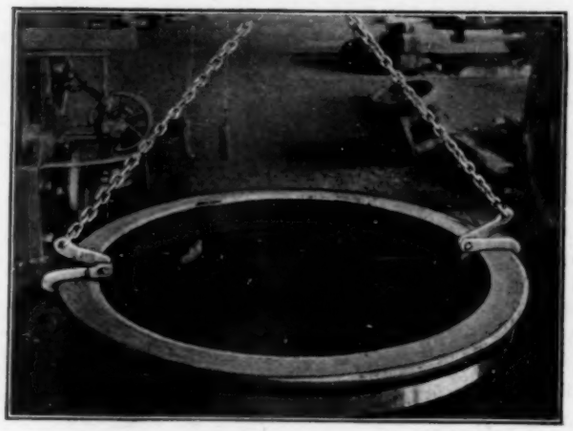


FIG. 2. TIRE SUSPENDED BY HOOKS

Fig. 1 the hooks are shown by themselves and in Fig. 2 their application to a tire is illustrated.

With these hooks tires can be picked up either when lying flat on the floor or standing on edge, and delivered where wanted.

Plan of Maintenance for Spline Broaches

BY GEORGE E. HODGES

The chief requisite of a spline broach is that it shall cut a clean, smooth, accurate hole. Because of the nature of the material upon which such broaches are ordinarily used and the severity of the service, such a tool is comparatively short lived and the tool cost of the operation is, therefore, relatively high. The purpose of this article is to show how the maintenance cost of spline broaches may be reduced to a minimum.

The width of the spline is the most arbitrary dimension, the size that must be maintained within the closest limits, for in a well designed job there should

be clearance between both the large and the small diameters of the shafts and their respective seats so that the sides of the several splines would bear the brunt of the work.

To maintain the necessary accuracy, high-priced broaching tools are used and, for the reason that the facilities at hand for regrinding them are usually inadequate, the tools are kept in service just as long as possible. The moment the resultant hole shows signs of having reached the low limit, they are scrapped.

It is scarcely advisable to grind broaches on the faces of the teeth. Few men can, or will, do this without changing the rake angles or drawing the temper. Rather should the teeth be honed on top with an oil-stone to restore the cutting edge. When the broach becomes too small to produce holes that will pass the gages, the plan here outlined may be employed. Though but one size of broach is shown in the sketch, the plan may be adapted to other sizes.

The broach selected to demonstrate the plan is of a size used extensively for popular priced transmissions on nickel-steel gear blanks presenting a 2-in. length of hole. Sections 1B are shown reground twice, although if thought advisable they may be reground twice more by using the 3B type of finisher and making necessary allowances on the pilot.

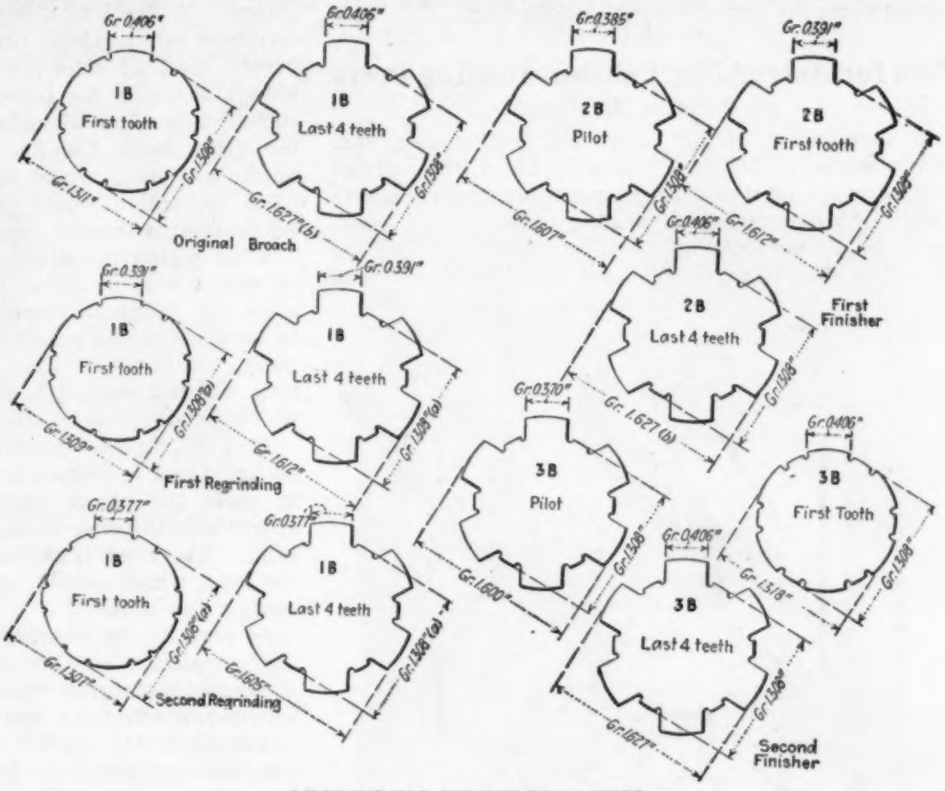
The original broach is used singly until it wears below size, when it may be reground by the following method: The broach is first straightened as accurately as possible, and its outer diameter ground and the teeth relieved on a plain cylindrical grinding machine. It is then mounted upon a planer type grinding machine and the splines ground, after touching up the body of the tool (marked *a*) to bring it concentric with the outer circumference.

The splines may have some tolerance, but the finisher 2B should enter the work easily. This finisher is a short tool and cuts on the tops as well as on the sides of the splines. It has little more to do than to clean up the hole and if it is properly made should hold its size well.

When the reground broach begins to cut small it shoul again be reground to the sizes shown in the sketch marked "second regrinding." When placed in production this time the finisher should be of the same length as the stocking broach, and for this reason. The finisher may, by regrinding, be brought to the original size of the 1B section if in designing the set the dimension marked *b* is kept to the maximum on the finisher and to the minimum on the 1B section. This would affect only the clearance between the outer circle of the shaft and its seat.

It will be noted that the figures given on the sketch indicate not more than 0.015 in. reduction on any of the dimensions. If more than this amount seems to be needed the broach is not straight and should be corrected before starting to regrind.

The cost of any of these regrinding operations should not exceed $15. Of course, a new tool is taken to start with and the two finishers are new. The 2B is the least expensive to make as it is shorter, and with the work it is called upon to do should stand up longer than the 1B. Although the regrinding calls for two operations, the saving in tool cost will more than repay the labor and machine cost.



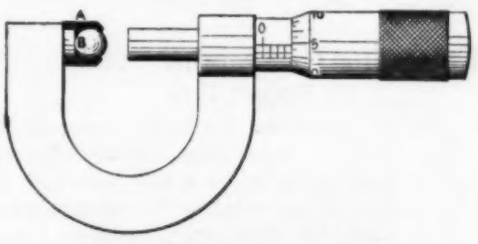
REGRINDING SPLINE BROACHES

The 3B type of finisher will outlast any of the other broaches and, when worn, may be reground to the 1B type and be as good as a new broach of that type.

A Micrometer Attachment

BY THEODORE C. HUMPHREYS

The attachment shown in the sketch may be found useful in measuring the thickness of the wall of tubing, and other similar jobs. *B* is a hardened ball 0.25 in.



MICROMETER ATTACHMENT

in diameter. *A* is a tube with a small shoulder to prevent the ball from falling out, but allowing it to extend through and rest against the anvil of the

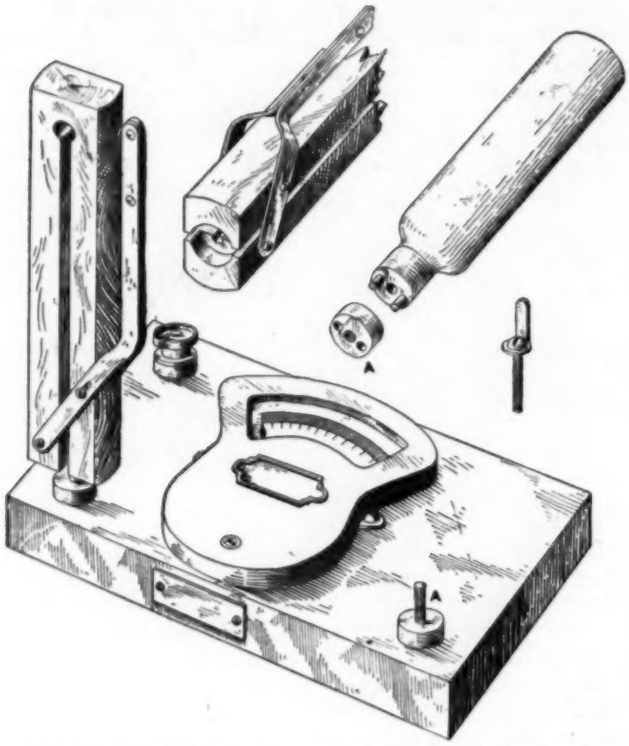
micrometer. The end of the tube is slightly spun over to hold the ball in place after it is inserted.

The tube should fit snugly on the anvil so that it will hold and yet be readily removed when not in use. In measuring, the diameter of the ball should be subtracted from the actual micrometer reading.

Tool for Assembling Polished Binding Posts

BY CHARLES H. WILLEY

In assembling certain electrical instruments that were mounted on polished mahogany bases, the nickeled binding posts, or terminals, were run on the screw with a spanner wrench having two pins to match corresponding holes in the binding post. The work of drilling these two holes in many thousand pieces was costly and



FRICTION WRENCH FOR NICKELED BINDING POSTS

the shop foreman eliminated it by making up several tools of hardwood, as shown in the sketch.

They were simple to make and were used as follows: The piece *A* was run on the screw with the fingers, being tapped an easy fit, then this wrench was applied and by gripping the lever, closed tightly on the piece. It was then turned a little and released, closed and again turned until the nut was tight.

Enlarging Gas-Engine Pistons

BY ROBERT TAIT

On page 638 of *American Machinist*, Ivan C. Beach gives his experience in expanding pistons of automobile engines by heating them to a red heat and allowing them to cool under a weight. In compliance with the Editor's request for data from readers I submit our experience.

We have been making automotive parts and doing general machine work for garages for a number of years and, of course, the work in this line which comes to us is generally accompanied by a request to "hurry it up" as the owner simply "has to have it right away," etc., and in the interest of universal peace we have enlarged, or attempted to enlarge, a good many pistons by the heat method.

There is nothing definite about the job. For instance: A car which has been quite popular in this territory has a 4¼-in. bore and another has a 3⅞-in. bore. Repeated attempts to expand the 4¼-in. pistons always met with flat failure, the expansion never being sufficient to allow of refinishing the pistons, while on the other hand the 3⅞-in. pistons, while containing much less iron, would always expand approximately 0.015 in. which would give stock enough to permit regrinding to several thousandths oversize.

Some piston manufacturers heat-treat their product as a means of relieving foundry stresses while others allow the rough castings to age before being finished to accomplish the result, and our supposition is that those pistons which have been heat-treated at the factory will not expand to any great extent, while those which have not been so treated, will expand.

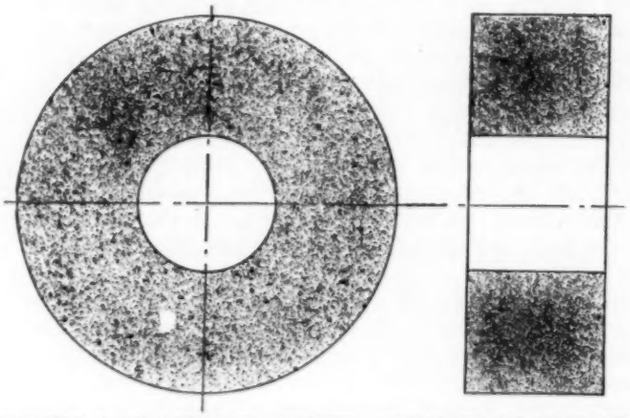
Weights, in our experience, have never helped. If enough force is exerted in this way there is a tendency to make the piston barrel shaped, but without any appreciable increase in expansion at the open end of the skirt. The most important point in this operation is the heat, which should be as high as possible without scaling the iron.

As regards the wearing qualities we have never had any complaints on this score and doubt if the slight difference enlarging causes in the structure of the iron would effect its wearing qualities. At best it is a makeshift job, rather in the nature of a court of last resort to which we have to appeal at times.

Stippling Drawings

BY E. H. BRUCE

In stippling drawings of abrasive wheels or stone work, time can be saved by covering all parts of the drawing, except that to be stippled, with a paper stencil which should be weighted down. Then take a brush such as a tooth or typewriter brush and dip it in drawing ink. Hold the brush at an angle about 4 in. above the drawing and by drawing a pencil or



DRAWING OF ABRASIVE WHEEL STIPPLED BY METHOD DESCRIBED ABOVE

stiff wire over the bristles, the ink can be directed to and splashed over the exposed parts of the drawing.

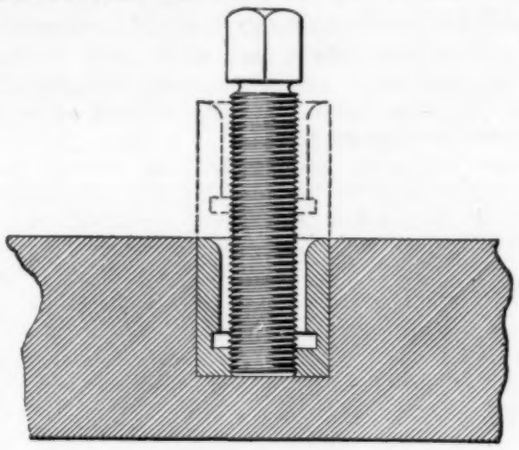
The accompanying illustration was made by this method. By a little care the ink can be distributed so that flat surfaces may appear convex or concave.

Removing a Bushing from a Blind Hole

By Art Weiss

On page 677 of *American Machinist*, W. H. Storey shows a method of extracting a bushing from a blind hole that is somewhat of an improvement over that first method suggested by C. Reimschissel.

Mr. Storey's method also requires some previous



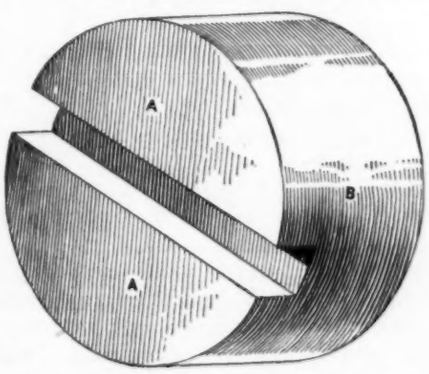
BUSHING FOR A BLIND HOLE

preparation and, like all the others, involves hunting up washers, etc., when the bushing is to be removed. Therefore, why not make the bushing as shown in the accompanying sketch and avoid having to hunt up anything with which to extract it? For years I have made bushings in this way and when they are to be taken out all that is necessary is to take a setscrew of the proper size and length, insert it in the tapped hole, and the bushing may be lifted out without further trouble.

A Kink in Local Hardening

By John F. Shunney

Having fifty pieces, like the one shown in the sketch, to be hardened upon the face *A*, we tried holding the heated pieces by means of tongs so that the face to be hardened would just touch the surface of the water. We were unable to get satisfactory results in this way, however, as the hardening would extend up the sides at *B*, where we did not want the pieces to be hard. We secured a plate of cast iron of suitable size and about 1 in. thick and cut narrow, closely-spaced grooves across it at right-angles so as to present a checkered surface. This plate we suspended in the hardening tank with the upper, or checked, face about even with the surface of the water so that the water would flow through the grooves but would not stand to any appreciable depth upon the plate.



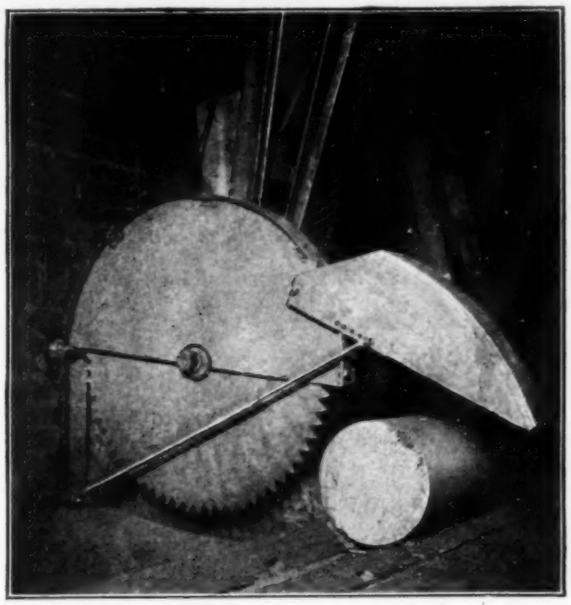
PIECES TO BE LOCALLY HARDENED

By setting the pieces on this plate as fast as they were heated we were able to harden the whole batch very quickly and in a satisfactory manner. The material was carbonized machinery steel.

Dangerous Swing Saw Guarded by Novel Device

By George F. Paul

A novel safeguard for a swing saw has been developed at one of the big factories at Niagara Falls, N. Y. An automatic guard is provided at the front of the saw and



GUARD FOR A SWING SAW

is actuated by a rod. An automatic latch prevents the saw from coming forward while the workman is placing material in position. A stop limits the backward movement of the saw. On the saw frame is mounted a light that serves to illuminate the cutting edge. The belt is guarded by the wire mesh in front and the frames on the sides.

Recommended Practice for Heat-Treatment of Carbon Steel Castings

The report of Committee A-4 of the American Society for Testing Materials has been prepared and copies are ready for distribution. The report will be presented at the annual meeting of the society in Atlantic City on June 26 to 30. Reprints have been distributed to the members with a view of stimulating discussion at the meeting. H. M. Boylston is chairman of the committee.

Sub-committees have been at work on the following subjects: Desirability of annealing iron chain at intervals; heat-treatment of rolled and forged carbon steel; heat-treatment of alloy steels; and the heat-treatment of carbon-steel castings.

On the last subject the committee has recommended that the castings be heated slowly and uniformly to temperatures varying with the carbon content of the steel. The recommendations are intended solely for guidance and are not to be construed as specifications of the society.

Copies of the paper can be obtained from the society, and criticisms are invited.

Editorial

Scientific Management

ON OTHER pages of this issue we present an Englishman's views on scientific management as related to British shops.

It would seem that this article carries under its surface more of a message to managers of industrial plants—here as well as abroad—than will be apparent on casual reading. The author emphasizes the fact that methods and systems must be fitted to the shops in which they are to be used. Some of us know to our sorrow that costly mistakes have been made in trying to adopt a particular system by swallowing it "Horse, foot and dragoons."

Scientific management is not new, however recently the name may have been coined. Noah followed a well defined system in building and loading the ark, but where he fell down was in its navigation. 'Tis true he finally made port, but it was not one of his own choosing.

Where Are the Good Machinists?

ONCE more the words of the economic prophets seem likely to be fulfilled. A shortage of skilled labor is in sight if it is not already upon us. It is not universal as yet, but it is spreading as the tide of increasing business rises.

As a result the machinery builder is soon going to be face to face with the problem of how to find the kind of men he needs to keep his shop going. When the first ripples of the business tide reach his door he is certain to find that the best men have been washed into the employ of his customers and he must bid high to get them.

Ample warning of the imminence of skilled labor scarcity has been given to members of the National Machine Tool Builders' Association by their general manager. The machine tool men are always the ones hardest hit by this ever-recurring condition by reason of the fact that their orders are about the last to pick up of any group in the manufacturing cycle. Their situation is a particularly difficult one because the nature of their product requires the highest type of machinists.

In the past they have had the very doubtful pleasure of seeing their best men and most promising apprentices attracted to other industries, notably the automobile industry, by wages much higher than they could afford to pay. Training machinists for the other fellow is not a very profitable undertaking for the man who does the training even though the industry as a whole gains thereby.

However, under existing circumstances the best way to have good men coming along seems to be to have apprentices in a carefully planned course in your plant and so to instill in them a spirit of loyalty to the company that they will stick with you even when temporary higher wages offer a tempting lure to other fields. Some companies have done this with marked success and they will be in an enviable position when business gets into full swing.

How the Army Could Help Civil Aviation

ONE of the recognized needs of civil aviation is landing fields where fuel, oil, etc., can be obtained. We are constantly urging the establishment of more fields and yet we are not utilizing as fully as we should the fields we already have.

There are army landing fields in various parts of the country and yet not one of them is available for civil use, even for an emergency supply of fuel, oil or other supplies. Of course the authorities do not prevent a pilot making a forced landing on an army field, but so far as assistance is concerned, he might as well land in the desert of Sahara.

A civil pilot in Ohio was recently forced to seek a landing owing to shortage of gasoline, and thought himself lucky to be within gliding distance of a large army field. But after landing he was unable to buy, beg or borrow a drop of fuel. Not through any lack of courtesy or consideration on the part of the officers in charge, but because the army regulations forbade it. He had to walk two miles to a town and hire a truck to bring him a supply of fuel.

It hardly seems possible that there can be any justification for such a ruling in times of peace. Everyone recognizes that the more civil aviators there are the better for an army in time of war.

Eternal Vigilance Is the Price of Eyesight

A RECENT bulletin issued by the Eyesight Conservation Council gives extracts from the study of Waste in Industry, under the auspices of the Federated American Engineering Societies. It points out the loss to industry still resulting from preventable accidents. In Pennsylvania alone in one year (1920) eighteen persons lost both eyes and 652 lost one eye, with a total of $826,724 as the cost in compensation only. The total for the industrially blinded is given at 15,000, or 13.5 per cent of the total blind population. The American Locomotive Company reports a great reduction in the number of eye accidents by the use of safety goggles.

Proper glasses are shown to be very necessary for the best results and a careful study of the conditions must be made. Without this, safety glasses may very easily be annoying in the extreme and not always an element of safety.

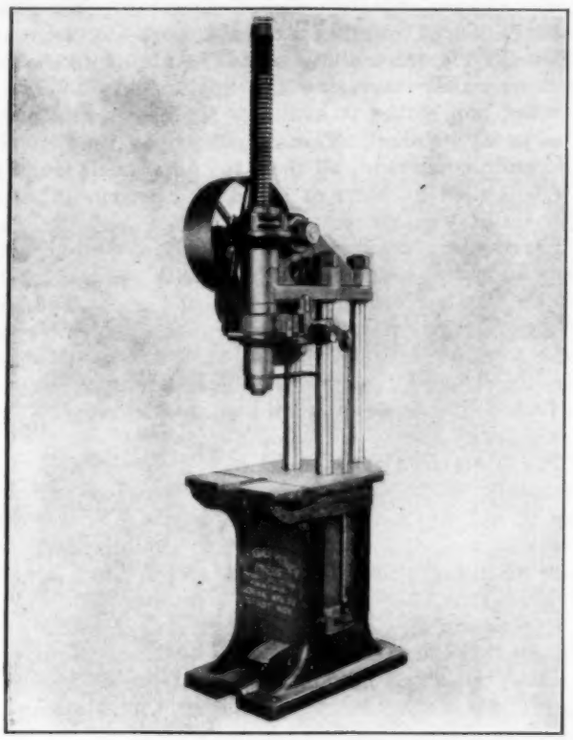
Nor are accidents the only things to be considered. The kind of light and the way in which it strikes the eyes of the worker are both important. This involves the proper location of machines with regard to the light, both natural and artificial.

The great need is for campaigns in the smaller plants, especially as the cost per man for bringing the light up to a good standard is usually greater than in larger plants. The cost of providing adequate illumination for the whole industry is given as being one-half of one per cent of the wages paid. This is a small sum as compared to the loss to industry, or to the possible burden on the community and the resulting suffering on the part of the individual.

Shop Equipment News

General Manufacturing Co. Flexible Power Press

The General Manufacturing Co., 255 Meldrum Ave., Detroit, Mich., has just placed on the market a flexible power press similar in principle to that described on page 117 of *American Machinist*. This machine, as the name implies, is flexible at the will of the operator as to the pressure applied, which may vary from a few pounds up to 8 tons. Because of this control feature, the press is especially adapted for straightening, for pressing in bushings, or for assembling parts having press fits. Having a stroke of 9 in., it may also be used advantageously for push broaching and similar jobs because of its adaptability.



"GENERAL" FLEXIBLE POWER PRESS

The press, shown in the accompanying illustration, is a three-post machine, mounted on a base with the table top 30 in. from the floor. Two of the posts are in tension, the third post is under compression. The ram is threaded with a long lead Acme thread and runs through a nut 4 in. in length, which nut is also the brake drum

Power is applied to the pulley by the belt; thence through a worm gear and spline key, driving the ram at constant speed in one direction. The nut turns with the ram until pressure is applied on the foot pedal. This pressure closes the asbestos-lined brake band on the nut and the ram passes down immediately through the latter until the pressure on the foot pedal is released, or until the pressure applied by the ram on the work equalizes the pressure applied on the foot pedal. The return stroke is obtained by a spring around the top of the ram, which raises the ram immediately after operation to its up, or normal, position, the nut turning freely on the ram as it rises.

The height between the end of the ram and the table in this machine is 12 in. Any other dimension, however, may be secured by using a different set of columns and length of control rod. The speed of travel of the ram depends entirely on the speed at which the pulley is run. For example, with the pulley running at 300 r.p.m., the ram travel will be 150 in. per minute. The end thrust is taken on a ball bearing between the nut and main casting.

Nicholls Portable Duplex Molding Machines

The William H. Nicholls Co., Inc., 2 College Place, Brooklyn, N. Y., has just placed on the market two models of portable, duplex molding machines. The machines are intended for use on long, narrow floors, and they can be moved along so as to minimize the distance which the sand, flasks and molds have to be carried.

The Model 14-42 machine, shown in Fig. 1, is intended principally for making copes and drags simultaneously. There are two adjustable screw heads, so that the height can be adjusted for different depths of cope and drag. In many cases the cope can be made on the split pattern plate attached to the jolt head, and the drag made on a right-hand side and rolled over before

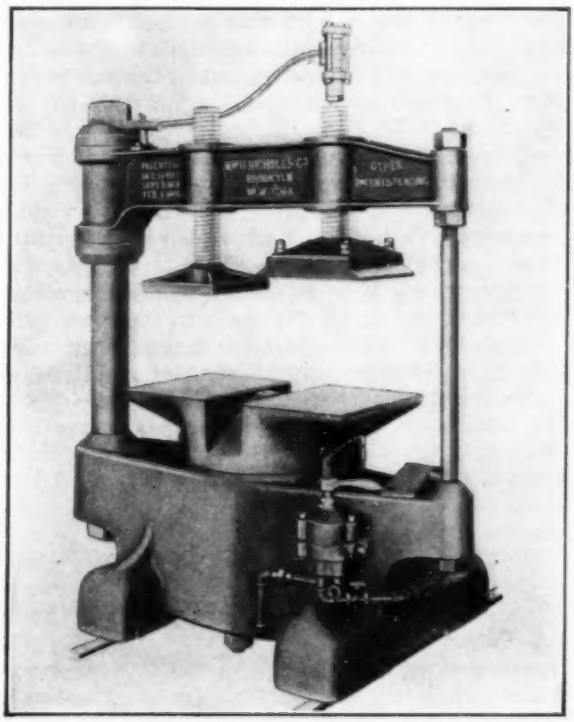


FIG. 1. NICHOLLS 14-42 PORTABLE DUPLEX MOLDING MACHINE

squeezing. The pattern can be drawn with the electromagnetic drawing device and both halves squeezed at the same time.

The squeeze is made on the up-stroke of the piston, and the draw on the magnetic side is made while the

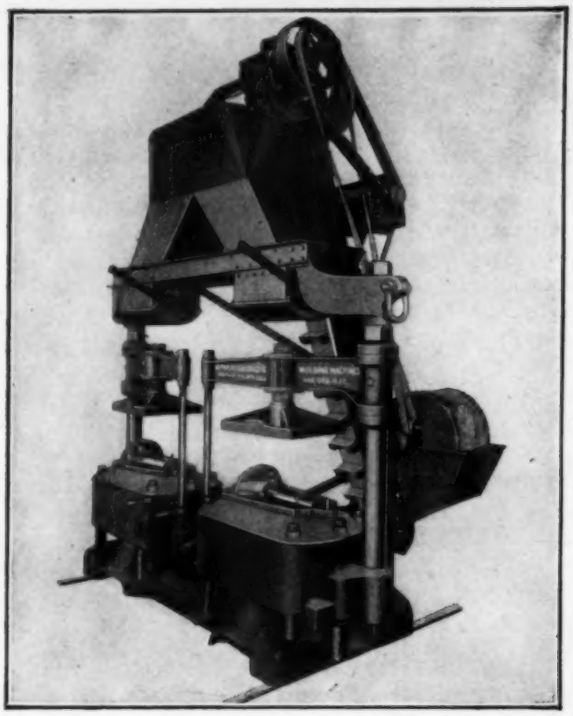


FIG. 2. NICHOLLS 12-36 TYPE D DUPLEX SELF-CONTAINED MOLDING MACHINE

mold is being withdrawn by gravity on the return stroke of the piston. The valve is placed low and has a horizontal handle. The position of the valve permits easy and quick operation in starting the jolting.

The machine has a 6-in. length of jolt and a 14-in. squeeze. All cast parts are made of semi-steel. The pins, bushings and contacting and drawing parts are of steel, hardened and ground.

The Model 12-36, Type D machine, shown in Fig. 2, consists of two stripping-plate molding machines mounted on the same base and made portable. A riddle, sand conveyor and a double boot hopper with sand gates are provided. The machine is set lower than the standard machines, and is about 10 ft. high to the top of the conveyor. It is self-contained and mounted on four wheels running on steel rails in the concrete floor. It is intended especially for large production in foundries where there are no sand or mold conveyors for bringing the materials to the machine.

The molds are shaken out and the sand piled the whole length of the floor. One man shovels the sand into the riddle, which cleans and mixes it. The sand is conveyed to the hopper, dropped into the flask and made into molds, which are set on the floor directly in front of the machine as it travels along. When the molds are shaken out, the flasks are placed in two rows, the copes on one side of the sand heaps and the drags on the other.

One operator can fill the two flasks with sand and jolt them while the other sets the cores. The two operators then strike off the drag and cope, squeeze them and help one another to put the molds on the floor. This machine is complete, and it not only mixes and conveys the sand into the mold, but gives a strong jolting action. The combination squeeze and drawing action semi-automatically squeezes on the up-stroke of the piston and draws by gravity on the down-stroke. Each half of the machine is operated separately by means of one valve for jolting, squeezing and drawing the patterns. All castings are semi-steel. The wearing parts are steel, hardened and ground. The equipment can be employed for continuous pouring, as it can be arranged for any degree of flexibility required.

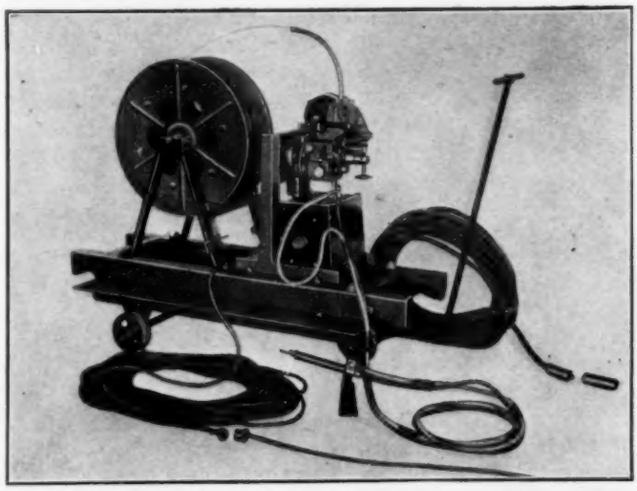
G.E. Portable Semi-Automatic Arc Welding Set

The General Electric Co., Schenectady, N. Y., has recently placed on the market a portable, semi-automatic electric arc welding set. The ability to move the machine easily increases the applicability of the apparatus, and makes it available for use in any part of the factory or shop. The set comprises complete semi-automatic equipment, all mounted on a small truck that can be pulled by hand or lifted by a crane. The complete outfit weighs about 400 pounds.

The welding equipment consists of a semi-automatic lead, an automatic welding head with control mechanism, and a standard for holding a reel of electrode wire. Power is supplied to the arc through a flexible cable with a plug for attaching it to the nearest welding circuit. The reel carrier is equipped with a brake and is intended to hold any size of reel up to 2½ ft. in diameter.

The portable outfit is particularly useful for repairing parts of machines in place when these parts are too bulky, inconvenient or otherwise impractical to move, as well as for doing routine welding of all sorts, such as filling holes in castings and welding seams in pipes or tanks.

It is stated that time can be saved in welding with the outfit because the electrode is fed continuously, and because the speed of deposition is from 25 to 100 per cent faster than that for hand welding. Material is saved by the elimination of waste ends, which usually amount to from 10 to 25 per cent of the total amount of electrode wire when it is used in short pieces. Since



G. E. PORTABLE SEMI-AUTOMATIC ARC WELDING SET

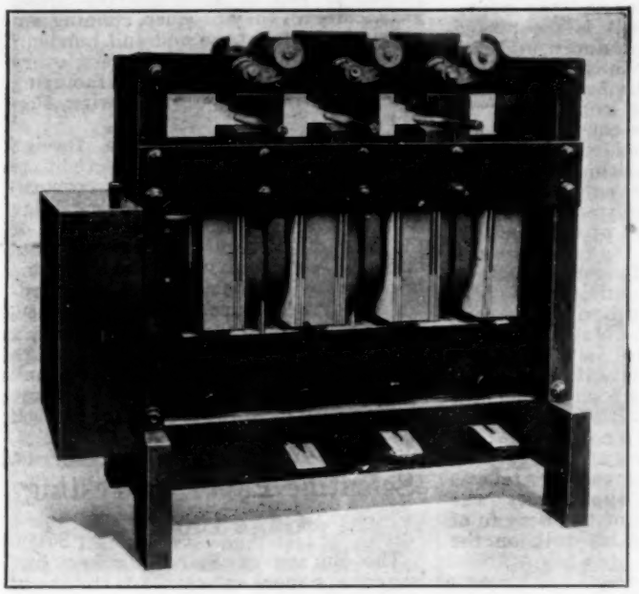
the welding operation is continuous, interruptions, which tend to affect the strength of the weld, are greatly reduced.

Berwick Electric Heater for Forging

The American Car and Foundry Co., New York, N. Y., has recently brought out the Berwick two-path electric heater illustrated herewith. The machine is intended especially for forging operations requiring the heating of the ends of bar stock or points along the length of the material. This heating is accomplished without burning or melting the metal. Either 220 or 440-volt current can be used.

The heaters are ordinarily built with one, two or three electrodes, and may be supplied with four or five electrodes if necessary. The length of the heat on the stock can be varied from 1 to 8 in., or the machine can be arranged to heat lengths from 3 to 11 in. With slight changes in the heater, this length can be increased to 16 or 18 in. The range of diameter of the stock heated on the No. 3 heater varies from $\frac{3}{8}$ to $\frac{7}{8}$ in. to obtain a high production rate, although larger stock can be handled.

The heater is similar in method of operation to the



BERWICK TWO-PATH ELECTRIC HEATER

Berwick rivet heater. The lower or left-hand electrode of each unit is stationary, while the upper or right-hand electrode has a vertical movement operated by depression of the treadle, which raises the electrode sufficiently to insert or remove the material.

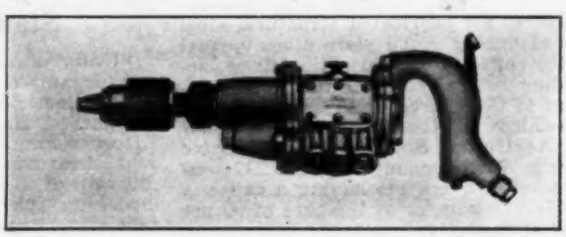
Each unit of the heater has two pairs of electrodes, insulated from each other. The right-hand electrode has at its two upper ends projecting blocks which overhang, but which are not allowed to touch the left-hand one. The left-hand electrode is stationary, so far as vertical motion is concerned, but may be adjusted horizontally by means of two bolts at the rear of the heater. Horizontal motion of the right-hand electrode is obtained by sliding the electrode-clamping device along the shaft on which it is mounted. Depression of the pedal causes rotation of the shaft, which through cams raises the shaft carrying the electrode.

Flexibility of the rear half of the bottom electrode is provided by a spring. The top face of the electrode is set at an angle so that when the upper electrode is dropped into position, contact is assured at four points on the material. Marring of the stock is decreased because of the increased number of points.

Thor "Pigmy" Portable Pneumatic Drill

The Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago, Ill., has recently placed on the narket the Thor "Pigmy" portable pneumatic drill that is illustrated herewith. The drill has a pistol-grip handle, with the control valve within easy reach. It is non-reversible. The device is very light in weight.

The drill is made in three sizes, the No. 25 size having a drilling capacity of $\frac{1}{4}$ in. and weighing only



THOR "PIGMY" PORTABLE PNEUMATIC DRILL

5 lb., the No. 375 size having a capacity of $\frac{3}{8}$ in. and weighing $5\frac{1}{2}$ lb., and the No. 50 size having a capacity of $\frac{1}{2}$ in. and weighing 6 lb. The speeds of the tools are 2,200, 1,400 and 1,000 r.p.m., respectively.

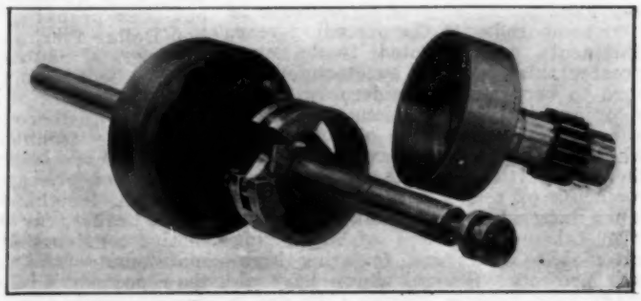
The drills are fitted with Jacobs chucks, the No. 25 having a No. 1B chuck, the No. 375 a 2B, and the No. 50 a 6B. A screwdriver attachment can be furnished; it is recommended especially for the No. 375 drill. A wire brush for cleaning purposes can be furnished for use on the No. 50 drill. The tool can, of course, be employed for reaming and wood boring, as well as drilling.

Friction Clutch for Greaves-Klusman Geared-Head Lathes

The accompanying illustration shows a friction clutch just placed on the market by the Greaves-Klusman Tool Co., of Cincinnati, Ohio, for use on its G-K geared-head lathes.

As compared with the former model, which expanded the ring on one side only and had one-sided fingers for spreading the ring, the present design expands the ring on both sides. The expanders are in the center of the clutch ring, operating to produce pressure directly on the toggle levers. Adjustment of the levers is by means of eccentric studs, so that the leverage applied always can be maintained the same. The driving hub is in one piece for both the forward and reverse clutches, giving a long bearing on the shaft and a long driving key.

The friction clutch has 50 per cent wider face, larger diameters on some sizes, and greater belt speed than in the former model.



GREAVES-KLUSMAN LATHE FRICTION CLUTCH

News Section

Structural Steel Sales Near Capacity

Orders for fabricated structural steel placed during April were almost equal to the capacity of fabricating firms, according to reports made to the Department of Commerce by firms comprising two-thirds of the fabricating capacity of the United States. Sales reported during April amounted to 115,247 tons by seventy-five firms having a capacity of 116,918 tons, or at the rate of 99 per cent of capacity.

At this rate, the total sales throughout the United States, based on a total capacity of 180,000 tons, were 177,600 tons in April. This compares with 139-300 tons reported for March by the Bridge Builders and Structural Society, based on reports of sixty-four firms showing sales at 77 per cent of capacity.

Experiments With Chilled Iron Car Wheels

Owing to the desirability of obtaining definite information concerning the magnitude and distribution of stresses in chilled iron car wheels and of determining the limit of these wheels as used today, with a further view of improving the chilled iron wheels in order to meet future requirements, an investigation was entered into by the Association of Manufacturers of Chilled Car Wheels and the University of Illinois. A bulletin presenting the results of the first part of this investigation has just been issued by the engineering experiment station of the University of Illinois. It is known as Bulletin 129 and gives the results of tests made to determine strain produced within the wheel by mounting it on its axle and by the application of wheel loads. The bulletin includes the general discussion of the general problem of wheel loading, the determination of the physical properties of chilled car wheel iron, a description of the apparatus and method used in the test, and a summary of the conclusions drawn therefrom.

Autos Growing Popular in Mexico

Imports of American motor vehicles into Mexico, consisting of 6,750 cars and 1,482 trucks, showed an increase in 1921 compared with the preceding year. Shipments are expected to be even greater this year, as automobiles are sure to contribute considerably in developing outlying sections. Already mining companies and oil operators, who have constructed roads between their properties and the railroads, are replacing ox teams with motor trucks. Much interest from official circles has been taken in matters of organizing automobile shows and fostering highway projects. Several shows have already been held in Mexico City and a national highway has been proposed to cover the entire country.

Weights and Measures Conference Urges Standardization

"Unity of action is impossible without organized conferences and established methods," said Secretary of Commerce Hoover in addressing the fifteenth annual conference on weights and measures, held recently at the Bureau of Standards in Washington. Speaking particularly to the state officials charged with the enforcement of laws pertaining to weights and measures, Secretary Hoover said: "Your work is not so much the prevention of crookedness and the apprehension of crooks, as it is the protection of the honest producer and distributor. I believe the vast majority of producers and distributors, as well as the whole of the consumers, are anxious that there be consistent scientific expansion in standardization."

There will be no legitimate objection to centralization, Representative Vestal, chairman of the Committee on Coinage, Weights and Measures, of the House of Representatives, told the conference, if the prosecution of offenders be left to the state and local authorities. "Let us have one central authority," he said, "to set up uniformity. Many manufacturers are writing to me asking for this very thing. This entire question is merely a matter of educating the people in standardization. Lack of standardization does not make for economy or for efficiency."

The program of the conference was so crowded that no opportunity was afforded C. A. Briggs, of the Bureau of Standards, to present his talk on the metric system.

Railway Mechanics Meeting and Exhibit

The third annual meeting of the mechanical division of the American Railway Association will be held in Atlantic City, N. J., June 14 to 21. This division comprises the former Master Car Builders and Master Mechanics Associations, and is the largest subdivision of the parent association. The exhibition this year will be the greatest ever attempted by the Railway Supply Manufacturers' Association, which acts in conjunction with the car builders. Over 100,000 sq.ft. of floor space has been prepared on the famous Million Dollar Pier, and the largest manufacturers of railway supplies will have display booths on the pier.

Headquarters of the convention will be the Marlborough-Blenheim Hotel, where the technical sessions will be held. These sessions will include discussions on prices, material, safety appliances, freight loading and equipment, brakes, car wheels, signals, locomotive construction, heating and boiler maintenance and sanitation. Committee reports will be received on welding, design, mechanical stokers, car dumping machines, tonnage rating and car repair shop layouts.

Final Declaration of Foreign Trade Council

At the close of the Ninth National Foreign Trade Convention, held last month in Philadelphia, the final declaration, which is a feature of the annual meeting of this body, was prepared and passed upon by the thirteen hundred delegates present from all parts of the country. The declaration, which is really a prescription or a suggested remedy for present business conditions, starts off with the statement that "the recovery of prosperity in the United States depends upon the ability of our people to sell at remunerative prices practically all they produce, running approximately full time and full handed."

The declaration, which covers every phase of business and manufacturing enterprise, includes the following subjects:

The need of foreign trade, foreign loans, foreign trade zones, credit to other nations, creation of loan corporations under the provisions of the Edge Act, reorganization to some extent of the Federal Reserve System, national taxation, merchant marine and marine insurance, simplification and standardization of procedure in trade practice, enactment of a trade act with China, a bargaining tariff, education in foreign trade, transportation, agriculture, and a final paragraph counseling courage and tenacity in the pursuance of foreign markets.

Scientific Paper on Testing Gage Blocks

The Bureau of Standards has just issued a paper, or rather a technical abstract of a paper, on the interference methods for standardizing and testing precision gage blocks. The experiment which led to the preparation of this paper was made by C. G. Peters and H. S. Boyd, of the bureau. The paper gives some interesting as well as new features of this very absorbing operation and the apparatus used for calibrating standards and comparing other gages with these standards is illustrated by line drawings and is thoroughly explained. The complete paper may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., for ten cents.

Bill to Supervise Weights and Measures

A bill regulating and controlling the manufacture, sale and use of weights and measures and of weighing and measuring devices has been introduced in the House by Representative Vestal, of Indiana, chairman of the Committee on Coinage, Weights and Measures. The bill confers jurisdiction over weighing and measuring devices on the Bureau of Standards, of the Department of Commerce, with authority to pass on their various types.

Business Outlook in Foreign Markets

The gradual return to a healthy business condition in foreign markets is evidenced by the cable dispatches to the Department of Commerce from the market places of the world. Conditions seem to be improving in all quarters, particularly in manufacturing centers. Unemployment is gradually disappearing and a final resumption of normal conditions is awaiting the bolstering up of the financial condition of the various nations involved.

The situation in Sweden in the iron and steel market shows a slight improvement. Production is slightly increased and prices are tending toward stabilization. Iron and steel production for the first quarter of 1922 is summarized as follows: Pig iron, 67,400 tons; Martin ingots, 41,500 tons; rolled iron and steel, 49,900 tons. Several foreign orders received during the spring have caused a resumption of work in three or four iron and steel mills.

In England there are distinct signs of improvement in the automotive field. A record trade was reported in some quarters before the dispute arose between the Engineering Employers' Federation and the Amalgamated Engineering Union, which began on March 11. Most of the manufacturers of motor cars and motorcycles are members of the federation. Since the lockout they have been short of toolmakers and machinists.

In Japan the manufacturing industries in the iron and steel trade are gradually resuming. Iron and steel imported into Japan in 1921 amounted to 1,500,000 long tons, and this year present indications are that this amount will be greatly exceeded.

The prospects for the introduction of American tractors into the Netherlands at the present time are considered fair, though the market is limited. The matter of credit terms for the sale of tractors and farm implements is of little importance, as the farmers can well afford to pay for what they are willing to buy.

In Poland the automotive field is hampered by high prices. A high-class make of American automobile costs about 20,000,000 Polish marks, a sum which only four or five people in Poland could afford to pay. There is little demand for American trucks in Poland at the present time, especially since used trucks may be procured from army stocks at low prices. Also, the low quality and high price of gasoline and oil are not conducive to motor-car popularity. It is estimated that there are no more than 6,000 gasoline motor vehicles in Poland.

The American market continues to offer a profitable market for American goods. Tractors and all kinds of farm machinery find a ready sale in many of the southern republics. Mexico is also improving along these lines. All the implements and farm machinery used in the various agricultural regions in Mexico are imported from the United States and there is always a good demand among the farmers of the Yaqui Valley and also in the Mayo and Sonora Valleys.

Other markets show encouraging signs of resumption of business and it is expected that heavy buying will prevail when exchange rates are stabilized.

British Merchandise Act

An important bill amending the present merchandise mark act which prescribes the requirements for the marking of goods imported into the United Kingdom, has recently been submitted to the British Parliament, according to advices received by the Department of Commerce. The provisions of the act deal primarily with the marking of goods as to class and origin and are intended to protect British industries from unfair competition by foreigners. The act also prohibits the importation into the United Kingdom of goods to which there is applied a forged trade mark or description, or any goods bearing a trade mark of those manufactured in the United Kingdom. American exporters to the United Kingdom would do well to follow this bill and its course through the British legislature.

Duty on Auto Bodies

Automobile bodies recently imported have been held by the United States Court of Customs Appeals to be dutiable of 20 per cent as manufactures in chief value of metal. The merchandise had been assessed as automobile bodies, dutiable at 45 per cent. The Board of Appraisers, in considering the complaint of the importers, held the merchandise dutiable at 15 per cent as manufactures in chief value of wood. The court however held the merchandise dutiable at 20 per cent as manufactures in chief value of metal.

Diesel Engines on Swedish Railroads

A report from Consul W. H. Sholes, of Goteborg, Sweden, states that high operating costs on Swedish railways have caused a number of transportation companies in western Sweden to experiment with Diesel motor railway engines. Among these companies should be mentioned the Sarobanan (The Saro Railway Co.) and the Goteborg-Boras Jarnvag (Goteborg-Boras Railway Co.). In the light of the Halmstad Nassjo Railway Co.'s success with such engines it is not unlikely that they will be more generally adopted in this section of the country.

The first Diesel motor railway engine (75 hp.) was put in operation in Sweden in 1914 and has been in constant use ever since. Larger engines have since been found necessary, and now the 160-hp. type is preferred. Considerable savings in fuel consumption are said to have been effected, and the fact that only one attendant is required, as compared with two on a steam locomotive, is another argument advanced in its favor. Its advent seems to have set at rest the oft-expressed fear that such engines might not be quite safe on railways with great traffic.

American manufacturers of Diesel motor railway engines and similar substitutes for the steam locomotive should find this section of Sweden a prominent field for their products. A list of the State and privately owned railways in western Sweden may be consulted by interested parties on addressing the Transportation Division of the Department of Commerce, and referring to Exhibit No. 52451.

Austrian Industries Had Poor Year in 1921

The Department of Commerce has received an interesting report on Austrian industrial conditions from Consul C. H. Foster, of Vienna. The report states that the year 1921 was a somewhat difficult period for those Austrian industries making finished iron and steel goods. Prices increased considerably, particularly for files and rasps, wire ropes, ordinary wire, iron furniture, and machinery, so that exports became more and more difficult. Cables and wire ropes were almost barred from Czechoslovakia and Hungary.

At the beginning of the year orders were scarce in the wire, copper, and brass industries, as well as for tubings, tools, motors, presses and hydraulic plants, and agricultural machinery, but conditions became better toward the end of the year. Unfavorable conditions prevailed throughout the whole year for pumps, wire ropes, lifts, and elevators. Until spring conditions were good in those industries turning out pitchforks, cables, and Diesel motors, but toward the end of the year German competition grew threatening. A lack of raw material was felt in the industries for metal goods and plows.

Plenty of orders were received for piano wire, so that the one Austrian factory was well occupied. Plows, files, and rasps were in good demand. Cutlery was exported to the extent of 90 per cent of the production, the percentage being especially high for agricultural knives and saw blades. Locksmith's goods equaled only 80 per cent of their 1913 production but sold well. Screws and rivets, iron furniture, metal goods, machines, scales and weights, bicycles, and firearms were frequently ordered and these industries kept well occupied. The machine industry worked under favorable conditions; factories making specialties had many orders and exports were numerous.

Locomotive factories worked mostly for deliveries to other countries. In 1921, 300 locomotives were delivered, as against 211 and 144 in the two preceeding years, but difficulties in procuring raw materials were felt. To meet all demands some factories had to erect new buildings and make great investments. The Austrian railway-car factories produced one-third of their output for inland use and were, therefore obliged to work for export.

Pneumatic Tube Service in Postal Appropriation Bill

In consideration of the conference report on the postal appropriation bill for next year, the House adopted the Senate amendment for the transmission of mail by pneumatic tubes or other similar devices in New York and Brooklyn, at an annual expenditure not exceeding $18,500 per mile of double line of tubes, making a total appropriation therefor of $513,911. It is provided that either party to the contract may apply to the Interstate Commerce Commission for a revision of this rate before July 1, 1923, its decision to be effective after July 1, 1923, but in no case shall the rate exceed $19,500 per mile.

Kinsey Exhibition of Mechanical Equipment

Under the auspices of the E. A. Kinsey Co., and in the showrooms of that concern in the Kinsey Building, 331 West Fourth St., Cincinnati, Ohio, an exhibition of machinery and mechanical equipment will be held on June 7 to 10. The show will be a complete exhibition of machine tools, accessories, labor and time-saving devices of the latest models in design and construction. Over forty of the largest manufacturers of such equipment will be represented at the show, which is intended to benefit factory executies, purchasing agents, superintendents, foremen and master mechanics. Experts from the factories manufacturing the various equipment and tools will be on hand to demonstrate and explain.

There will be no selling during the exhibition, so that the entire time can be devoted to an undisturbed study of the machinery on exhibition.

Office Managers Meet at Washington

The third annual conference of the National Association of Office Managers was held in Washington, D. C., May 18 to 20. One hundred representatives of many of the largest concerns in the country were present to discuss principles of office management, and to exchange ideas looking to the more economical and efficient operation of large offices.

The meeting was addressed by speakers of note on such topics as: "Possibilities and Limitations of Psychology in the Office," by Dr. John B. Watson of New York; "United States Budget Bureau and Principles of Budget Making," by Gen. H. M. Lord, U. S. A.; "Personnel Work in the Office," by Dr. Charles R. Mann, of the War Department; and "Modern Office Planning," by Harry A. Hopf of New York.

The officers of the association are: President, F. L. Rowland, Gilbert & Barker Manufacturing Co.; first vice-president, G. R. Hulverson, Burroughs Adding Machine Co.; second vice-president, L. E. Stacy, Spirella Company; secretary, G. S. Childs, Alexander Hamilton Institute; treasurer, C. W. Kirkpatrick, Fisk Rubber Company.

Chemical Industries To Exhibit Machinery

The Eighth National Exposition of Chemical Industries will be held this year in the Grand Central Palace, New York City, during the week of September 11. It will follow immediately upon the fall meeting of the American Chemical Society.

The raw materials to be exhibited will be of the natural resources from out of the earth and above the earth. The machinery exhibits will consist of apparatus and equipment and instruments for control, precision, recording, gaging, measuring, and machinery for every mechanical operation in the manufacture of products from the raw materials. Many new things upon which manufacturers were working when the war ended, and which have since been more leisurely perfected, will be shown for the first time.

Engineering Council Recounts Its Achievements in 1921

The annual meeting of Engineering Council, of the Federated American Engineering Societies, was held in Pittsburgh May 26 and 27. It was the most successful meeting in the history of the council, and the reports of committees and officers showed great progress and recognition of the position of the engineer in public life. President Mortimer E. Cooley presided and in speaking of his tours throughout the country during the year, said that everywhere he found evidence that the federation idea was growing, and that substantial additions to membership might be expected in the near future. The most important discussion of the meeting was the registration of engineers, to control which laws have been passed, or are in process of legislation, in many states. The council expressed the opinion that such legislation may properly cover engineers and architects charged with the responsibility of public works, but not mining engineers. A resolution that the employment committee of the council go on with its investigation of the employment situation was adopted. The committee was requested to study and report any possibility of co-ordinating existing and local employment services into a national service. Another resolution adopted directs the council's committee on water power to place before the President the facts of the situation with regard to water power development in this country. A movement to conserve our national forests was set in motion by the appointment of a committee to study this phase of our national development. The board pledged its support to President Harding in his plan of government reorganization, and decided to keep up a nation-wide movement for the establishment of a Department of Public Works in the Cabinet. It was also brought out that committees are at work on a general policy of affiliation of American engineers with the engineering bodies of other nations. A movement is now on foot in Europe, led by Sir Robert Hadfield to form an Anglo-Saxon union of engineers, which shall include all the English speaking people of the world. Secretary Wallace's report recounted the achievements of the council during the past year. He gave some interesting figures, showing how the organization has helped the Government and business men in various ways.

Southern Metal Trades in Savannah

The fifth annual convention of the Southern Metal Trades Association is to be held in the Savannah Hotel, Savannah, Ga., June 19 and 20. This meeting will be devoted mostly to the hearing of reports from the officers of the association. Only two papers will be presented according to present arrangements. These are "Signs of the Times," by T. M. Cunningham, Jr., of Savannah; and "Sidelights on Cupola Practice," by Patrick Dwyer, editor, *The Foundry*, Cleveland, Ohio. G. F. Meehan, president of the association, will preside. The annual banquet will be held on the evening of the nineteenth in the banquet room of the hotel.

Invitation to Meeting of Construction Council

Lacking facilities at present for direct communication with the thousands of important men in the construction industry, the temporary directing committee of American Construction Council extends a personal invitation to each member of the industry to attend the organizing meeting in Washington, D. C., on June 19 and 20.

The step contemplated, that of bringing together for co-operation in behalf of the industry and of the public all the elements of construction activity—engineers, architects, labor, the contractors, the manufacturers and dealers, and the financial interests—is epochal in American industry. It deserves, and promises to have, the full support of the entire industry.

Full details of the plan are set forth in a comprehensive pamphlet, procurable from the temporary office, 1053 Munsey Building, Washington, D. C. The meeting will be held in the Washington Hotel. Secretary of Commerce Hoover will preside. R. C. Marshall, Jr. is chairman of the temporary directing committee.

Advertising Conference at Milwaukee

The program for the first National Industrial Advertising Conference, to be held in Milwaukee from June 11 to 13, has been just announced by the chairman of the conference, Keith J. Evans, advertising manager of Joseph T. Ryerson & Sons, Chicago. At the technical session, the speakers have been selected from a variety of industries and professions in the country. Some of the papers scheduled for presentation are: "Advertising as a Factor in Inter-Industrial Marketing," by W. W. Coleman, president of the Bucyrus Company, Milwaukee; "What the Department of Commerce is Doing to Aid Inter-Industrial Marketing," by F. M. Feiker, vice-president, McGraw-Hill Company, Inc., formerly assistant to the Secretary of Commerce; "Cutting the Cost of Distribution or Marketing in its Relation to Industrial Development," by Congressman Anderson, of Minnesota; "Advertising in Its Relation to the Four Points of Contact in Industry," by Bennett Chapple, director of publicity, American Rolling Mills. Speakers at some of the other sessions will be: Charles H. MacIntosh, of LaSalle Extension University; J. C. McQuiston, manager, Westinghouse Electric and Manufacturing Co.; H. Colin Campbell, manager of publicity, Portland Cement Association; Morris W. Leith, formerly Hill, Clark & Co.

Power Plant Exposition in New York

Announcement has been made of the National Exposition of Power and Mechanical Engineering to be held at the Grand Central Palace, New York, from Dec. 7 to 13.

The exposition will immediately follow the annual meeting of the American Society of Mechanical Engineers and it is expected that the exhibits will supplement the programs and discussions at the professional meetings of the society.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

(Copyrighted, Theodore H. Price Publishing Corporation, 16 Exchange Place, New York)

By an unusual coincidence last week included "Derby Day," "Memorial Day" and "Whitsuntide." The first is practically though not legally a holiday in England; the second, "Memorial Day," is widely observed as a legal holiday throughout the United States; and the third, "Whitsuntide," has become a vacation period in most of western Europe.

The result, in so far as business is concerned, was comparative quietude, of which we may take advantage to survey and interpret conditions. The revival has now reached the median stage and it is more difficult to read the future when things are on an even keel when they are at one extreme or the other.

At present every one is fairly cheerful. President Harding, and all his administration, is loudly proclaiming the advent of prosperity. Election day is approaching and there is, of course, a factor of political self interest in the cheerfulness, but there is also a substantial basis for it. As always, there are some things that are not as they should be but "normalcy" is not perfection and the ideal will not be attained this side the millenium. But good times are due to the dominance of the constructive spirit, and that spirit seems now to be spreading. It was thwarted at Genoa, but it has reasserted itself in the bankers conference at Paris as a result of which a loan of $1,000,000,000 will probably be made to Germany now that she has accepted the terms imposed.

Effect of the Loan

The stimulating and stabilizing effect that this loan will have in Europe is hardly appreciated in America as yet. It has already lifted sterling exchange to the highest figure touched since July, 1919, and even marks have advanced slightly in anticipation of German deflation.

That they can ever recover their prewar value seems impossible, but it is thinkable that a revival of speculative activity may carry them much higher, for at their present value of 38 cents a 100 the entire 142 billion marks now outstanding are worth only $539,000,000; this is hardly more than half the loan that is under consideration. If marks go up it is probable that the other depreciated currencies of the Old World would advance concurrently.

The result would be a sudden and substantial increase in the purchasing power of Eur It is plain that this would mean much to America as well as to England and its tonic effect is to be reckoned with as a possible and a very important influence. Certainly the program of reconstruction in Western Europe seems sufficiently advanced to justify reliance upon its ultimate completion and there is reason to hope that as it progresses sane government may be established in Russia.

So much for conditions overseas. Turning from them to our domestic affairs there is equal reason for confidence. Unemployment continues to decrease, bank clearings are steadily improving, retail trade is gaining.

With the exception of wheat, which has declined sharply because the "May deal" has collapsed, the great agricultural staples are selling at prices that are fairly satisfactory. The steel mills are getting busier; some of them are working up to capacity. The automobile business is booming.

Railroad earnings for April were surprisingly good when the curtailment of coal traffic is considered. Good judges expect a further improvement after July 1 when the lower freight rates become effective.

The reduction in employees' wages ordered by the Labor Board has led some of the Brotherhoods to order a vote upon the question of striking, but no one expects that it will be anything more than a gesture. The textile strike in New England is gradually settling itself as the hands return to work and the mills reopen one by one. By "moral suasion" Secretary Hoover is trying to fix the price of bituminous coal at $3.50 f.o.b. West Virginia mines during the continuance of the strike. He may not succeed but if he fails Congress will probably give him the legal authority that he lacks in order to deal effectively with a very perplexing and difficult problem. Credit is abundant. Money is easy and the weekly statement of the Federal Reserve System shows a gain of one-half of 1 per cent in the reserve ratio, which now stands at 78 per cent. This is apparently due to a decrease of 40 millions in deposits for there has been no change in the amount of gold held.

Winter Wheat Promising

It is too early to say much about the condition of the crops, though the indicated yield of winter wheat is slightly in excess of last year, but barring the unforeseen and assuming a satisfactory harvest it seems reasonable to count upon good and improving business for at least six months. This will carry us up to and over the elections and while it is not to be inferred that their effect will be disturbing it is admittedly uncertain and business abhors uncertainty. With this conservatively optimistic view the security and financial markets seem to be in agreement. A renewed demand for bonds was met with a number of new issues, including a loan of $24,000,000 to the Republic of Bolivia, which was offered and well taken on a basis which yields 7.92 per cent.

The stock market has been relatively quiet. The Supreme Court has severed the Central Pacific from the Southern Pacific Railway, but the union forbidden would probably be legal under the Esch-Cummins Bill and it is doubtful whether the severance decreed will ever become a fact. The reorganization of the International & Great Northern has been completed. It probably presages the acquisition of that railroad by the Frisco.

The merger of the Republic Iron and Steel Co. with the Midvale and the Inland Steel Co. is also announced, but many legal hurdles will have to be cleared before it can be consummated. The Tobacco Products Co., the United Retail Stores Corporation and the United Cigar Stores Co. have also been put together, but the market effect of these combinations has been negligible, for speculators have ceased to believe that the whole can be made greater than the sum of all its parts.

This is one reason why the recent advance in securities represents an appreciation of real rather than fictitious values. It rests upon the substantial basis of intelligent investigation, for at no time since it commenced last January has there been much reckless speculation. Therefore there is reason to expect a further advance as the prosperity of the country is reflected by increased earnings, and it is among the railway stocks that the most striking examples of the relation between larger corporate profits and higher market values will probably be found.

Commodity Markets Firm

The commodity markets call for but little comment. Sugar has been conspicuously firm and substantially higher prices seem indicated by the rapidity with which the supply has been absorbed. Rubber is also in better demand at a slight advance. Cotton halts around 20 cents with the trade in doubt as to the accuracy of the many crop reports, public and private, that have been issued. The statistics indicate ultimate scarcity, but a present sufficiency and with every one bullish experience suggests caution rather than blind confidence in a further advance.

The sensational losses sustained by those who were long of May wheat have had a sobering effect upon the Chicago Board of Trade, but the market there now has a healthier tone and present prices are probably below intrinsic values. Petroleum and most of its products are higher. The supply is increasing but so is the demand.

The dry goods trade in both woolen and cotton goods is more active and prices are higher. Small stocks and a shortage in many lines are reported. An unusual demand for women's footwear is noted, though men do not seem to need as many shoes as formerly. Tariff uncertainties are creating some areas of dull trade in imported goods and the bonus bogy has been revived.

But the vagaries of Congress and the coal strike are about the only clouds in the June skies. They are not sufficiently dark to obscure the sunshine. The public has become accustomed to them. They are no longer feared, and those who are unafraid are not easily depressed.

Machinery Exports Drop Lower in April

Exports of metal-working machinery dropped back again in April. The value of all exports of such machinery in April of this year was $786,951. This is a quarter of a million dollars less than in March and but little more than one-third of the value of such exports in April of 1921. The detailed figures, taken from the work sheets just compiled by the Bureau of Foreign and Domestic Commerce, are as follows:

EXPORTS OF METAL-WORKING MACHINERY

	April, 1921	April, 1922
Lathes	$335,614	$45,608
Boring and drilling machines	.....	25,280
Planers, sharpeners and slotters	.....	25,685
Bending and power presses	.....	644
Gear cutters	.....	3,307
Milling machines	.....	17,591
Sawing machines	.....	1,329
Thread cutting and screw machines	.....	15,229
Punching and shearing machines	.....	8,700
Power hammers	.....	5,723
Rolling machines	.....	221
Wire-drawing machines	.....	808
Polishing and burnishing machines	.....	2,879
Sharpening and grinding machines	84,946	67,804
Chucks, centering, lathe, drill and other	.....	10,105
Reamers, cutters, drills and other parts for machine tools	.....	122,851
Pneumatic portable tools	.....	17,919
Foundry and molding machinery	.....	35,834
Other metal-working machinery and parts of	.....	379,434
Total metal-working machinery	$2,055,422	$786,951

IMPORTS

Machine tools	$29,412	$10,818

AUTOMOTIVE EXPORT FIGURES

	April 1921	April 1922	Up to May 1 1921	Up to May 1 1922
Passenger cars	$2,931,233	$4,822,737	$15,338,322	$13,236,698
Trucks	.....	647,747	5,346,896	2,054,970
Parts	3,195,698	3,933,438	19,399,931	12,428,855
Total	$6,126,931	$9,403,922	$40,085,149	$27,720,523

Metal Trades Grow in San Francisco District

"Payrolls are what make for improvement in banks, stores, buildings, homes, education and culture, and the manufacturing metal trades provide the steadiest and biggest yearly payrolls of any industry."

This statement of the importance of the metal trades industry in San Francisco's economic life was made by Fred Metcalf, commissioner of the California Metal Trades, in a discussion of this subject prepared for the San Francisco Chamber of Commerce. The recently completed industrial survey of 1920 business made by this chamber was the first definite and planned attempt at such local inventory, and while it was probably incomplete because of the newness of the idea, it showed very concisely the principal sources of the city's income.

With only 380 metal trades firms reporting, the survey showed the metal group near the head of the list in point of payroll, number of men employed and value of plant equipment. The totals make impressive reading for business men. The $28,349,763 paid to the 21,816 workmen in wages was either spent in the stores, or for homes, or deposited in savings banks. A good part of the $137,281,180, representing the value of the products, was in local supply houses and by them put into circulation on their payrolls.

Plant and equipment represent an investment of over fifty million dollars, which is being devoted to build up an industry to compete with other sections of the country.

A large part of the machine shop equipment in San Francisco is up to date, says the report, but more machinery is needed in other trades and particularly automatic machinery for quantity production.

Briefly summarized, the metal trades industry of the San Francisco Bay District is today equipped to handle practically everything that is required in its line. The report further states that there are five shipyards, equipped with accommodations for the smallest up to the largest vessel. There are six marine ways that will handle up to a 5,000-ton ship. All of the six larger yards are equipped to do machine and boiler work, and the three largest have fully equipped machine and boiler shops to handle jobs of any nature and size.

There are forty-five foundries, both iron and brass. Five steel mills are in operation. Mining machinery, pumps, pulleys and conveyors, refrigerating equipment, overhead cranes, hoisting machinery, boilers, tanks, compressors, canning machinery, hydraulic and electric presses, tools, gears, saws, bolts, nuts, elevators, heating plants, oil-burners, dredging equipment, cars and running gear, filters, water wheels and such lines are specialized in by approximately thirty-five firms in San Francisco.

Selling the World

Through the efforts of a committee of trade association executives, appointed by Gordon Lee, chief of the automotive division of the Bureau of Foreign and Domestic Commerce, of the Department of Commerce, a booklet has just been issued by that department, entitled "Selling the World." It is really a piece of sales promotion literature and this is probably the first time that a Government department ever used this means of offering its services to the industry which it represents. The report outlines the opportunities available for American automotive manufacturers in international trade, and shows how practical commercial assistance is being given by the automotive division of the Bureau of Foreign and Domestic Commerce, under direction of Mr. Lee.

Associations which aided in the preparation of this book were: The National Automobile Chamber of Commerce; Motor and Accessories Manufacturers Association; Automotive Equipment Association; Motorcycle and Allied Trade Association; National Association of Engine and Boat Manufacturers; Association of Automotive Equipment Manufacturers; The Black & Decker Manufacturing Company.

British Manufacturer Here on Business Trip

Arthur Hungerford Pollen, chairman of the board of Burton, Griffiths & Co., Ltd., and of the B. S. A. Tools, Ltd., of England, has arrived in the United States to visit the manufacturers which his company represents in Great Britain.

Mr. Pollen is a writer of international reputation on naval subjects, is a graduate of Oxford University, a keen student of economic developments and for many years has been a director of important British manufacturing corporations. He is also chairman of the executive committee of the British Commonwealth Union, an association of leading manufacturers and industrial corporations in Great Britain organized for the study of legislative questions affecting industry, and for presentation of economic facts to the public. Mr. Pollen is a director of the Linotype and Machinery, Ltd., and also a director of the Mergenthaler Linotype Co. of New Jersey. The companies affiliated with Burton Griffiths & Co., Ltd., and the B. S. A. Tools, Ltd., are: Wm. Jessop & Sons, Ltd., Brightside Works, Sheffield, England; B. S. A. Tools, Ltd., Sparkbrook, Birmingham, England; B. S. A. Guns, Ltd., Small Heath, Birmingham, England; B. S. A. Cycles, Ltd., Small Heath, Birmingham, England; B. S. A. Company, Ltd., Small Heath, Birmingham, England; the Daimler Co., Ltd., Coventry, England.

Engineer Delivers Books to Russian Library

Theodore Weinshank, engineer, of Indianapolis, and member of the American Society of Mechanical Engineers, has just returned from Russia, whence he went as the emissary of the society, to deliver the nucleus of a technical library of 810 volumes of books on scientific and engineering subjects. Mr. Weinshank delivered a package of thirty volumes of up-to-date engineering books at the Bolshevik headquarters at Kremlin. There he talked to the head of the mechanical rehabilitation division of the Bolshevik government, G. Krjijanovski. The library, which will consist of the full 810 volumes when complete, will be in English, French and German, and will be opened at Kremlin, in charge of a Soviet official. The society believes that it will be a good investment for American manufacturers, because it will make it possible for Russian engineers to so develop their industry that the need for American machinery and manufactured products will be necessary to the complete reorganization of their industries.

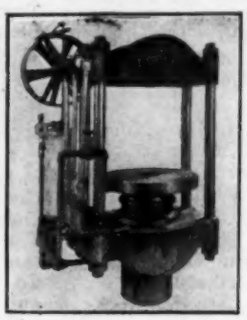
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Press, Tire, Hydraulic

West Tire Setter Co., Rochester, N. Y.

"American Machinist," February 23, 1922

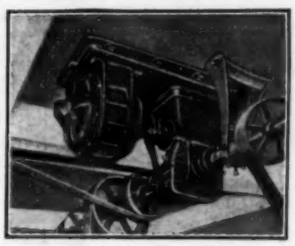


The press is used in pressing solid rubber tires on and off automobile truck wheels. A ram 16 in. in diameter gives a maximum pressure of 250 tons at the platens. The press is driven by belt on a 30-in. pulley running at 175 r.p.m. The pump, located at the side of the lower resistance member, has three plungers, one large and two small. Platens, 42 in. in diameter; maximum vertical distance between platens, 37 in. Ram stroke, 33 in. Vertical strain rods: diameter, 4¼ in.; distance apart, 43 in. Height, 9 ft. 3 in.

Drive, Line Shaft, Worm

Cleveland Worm and Gear Co., Cleveland, Ohio

"American Machinist," Feb 23, 1922

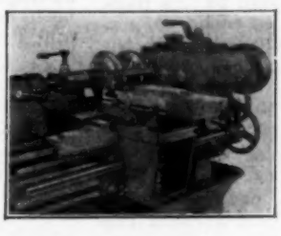


The connection between motor and shaft through the worm and worm wheel eliminates speed fluctuation due to belt slip. With the large speed reduction ratio, a motor operating at 1,800 r.p.m. can be used, even for shafts running at low speed. The reduction unit is mounted on a bed plate with the motor, and the whole attached to the ceiling, or placed upright on a platform. The drive mechanism is compact and completely inclosed.

Attachment, Lathe, Back-Facing, Semi-Automatic

Seneca Falls Manufacturing Co., Inc., Seneca Falls, N. Y.

"American Machinist," February 23, 1922

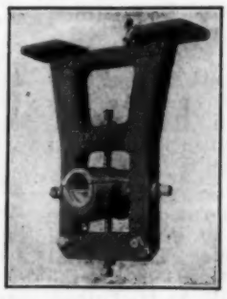


The device is adapted to bevel gear work, bevel cuts being made at the same time the shank is turned. It has nine in-feeds from 0.003 to 0.050 in. per spindle revolution, and 27 reverse feeds from 3 to 15 times the forward feed, to secure the proper timing for back-facing, necking, under-cutting and grooving. The in-feed stop will reverse automatically, and the out-feed automatically stops at the end of the cycle.

Hanger, Line-Shaft, Pressed-Steel

Dodge Sales and Engineering Co., Mishawaka, Ind.

"American Machinist," February 23, 1922



The hanger is intended for general use where extreme vibration is not encountered, and is not adaptable to heavy-duty. It is light and strong, being made of sheet steel pressed to shape and riveted and bolted together. The bearing floats in the hanger so as to align itself to the shaft. By setscrews with locknuts, the bearing can be brought to the proper height and lateral position.

Lathe, Gap, 11 x 24 In.

Artisan Manufacturing Co., Cincinnati, Ohio

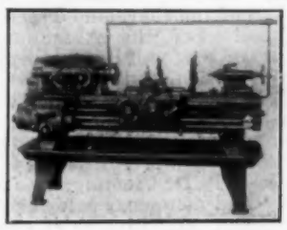
"American Machinist," February 23, 1922

The lathe has a quick-change feed box containing the gears and a clutch for engaging and disengaging the feed, operated by a lever. The double-crank handle at the right of the feed box is for manipulating the feed by hand. Standard threads from 8 to 224 per in. can be cut, including a 11½-in. pipe thread. The cross-slide can be swiveled for turning angles. A ½-hp. motor may be attached to the machine. Sliding back gears with a three-step cone pulley give six speeds, in geometrical progression. Swing: over carriage, 6¾-in.; in gap, 16-in.

Lathe, Toolroom, 14-In., Sundstrand

Rockford Tool Co., Rockford, Ill.

"American Machinist," February 23, 1922

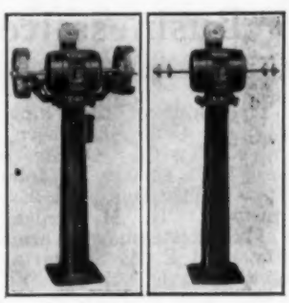


The lathe can be furnished with either cone or geared headstocks. The 4-step cone headstock is single back-geared with ratio of 8½ to 1, and takes a 2½ in. belt. The carriage is controlled by a handle on the stop rod at the right of the apron. When cutting threads, the carriage can be automatically stopped by collars on the stop rod. A threading dial is furnished for thread cutting. Forty-eight thread and feed changes ranging from 1½ to 92 are provided. Swing: over bed, 15 in.; over carriage, 8¾ in. Feeds, 6 to 268 r.p.m. per inch. Floor space, 27 x 82 in. Weight, 2,500 lb.

Grinder and Buffer, Electric

Columbia Manufacturing Co., Belleville, Ill.

"American Machinist," February 23, 1922



The machine is used for sharpening tools and for general light machine shop or garage grinding. It is driven by a ¼ hp. electric motor, operating at 1,800 r.p.m. on single-phase, alternating current of 60 cycles and either 110 or 220 volts. The grinder is supplied also for bench use, and is equipped with adjustable tool rests, wheel guards and water pot. Wheels 8 in. in diameter and 1 or 1½ in. thick are used. A switch is mounted on the motor. Spindle: ¾ in. diameter; length, 23 in.; height from floor, 36½ in. Weight, 145 lb.

Hardness Testing Punch, Portable, "Auto Punch"

Case Hardening Service Co., 2283 Scranton Road, Cleveland, Ohio

"American Machinist," January 19, 1922

The device is made in two sizes, the 12-in. size for work on steel, iron and hard metals, and the 6-in. size for sheet brass and thin metals. By pressure on the barrel the spring hammer is released and strikes the ball. The resulting depression in the work is then measured, as in the Brinell test. The tested piece must rest on a solid support, but usually can be tested in position. The hardness of steel plate, stampings, forgings and castings, as well as that of case-hardened and heat-treated work, can be determined. A pressure of 850 kg. on a ¼-in. ball gives a depression of the same size as that of the 12-in. punch when testing mild steel.

[This clipping supersedes the one appearing on page 688g.]

Tractor Company to Build Motor Car

The Cleveland Tractor Co., well known as makers of Cletrac tractors will shortly be reorganized as the Allyne-Zeder Motors Co., and will take up the manufacture and distribution of a new six-cylinder automobile, which is being designed by F. M. Zeder, formerly chief engineer of the Willys Corporation and also at one time connected with the Studebaker interests. The new corporation will have a capital stock of approximately $10,000,000.

A subsidiary company, to be known under the old name of the Cleveland Tractor Co., will continue the marketing of Cletracs through the present distributors and dealers. A new one-ton truck, designed by R. H. White, will be added to the Cletrac line in the near future. Two of the Studebaker family will return to the automobile industry in the organization of the Allyne-Zeder Co. Clement Studebaker, Jr., and his brother, George M. Studebaker, former directors of the Studebaker Corporation, will be stockholders in the new automobile company. Rollin H. White, president of the Cleveland Tractor Co. and a director of the Aluminum Manufacturers' Inc., will be president of the new corporation. Other officers will be: R. T. Hodgkins, vice-president and general sales manager; A. F. Knobloch, vice-president and works manager; F. M. Zeder, vice-president and chief engineer; T. D. Fleming, treasurer: E. D. Wilson, motor car sales manager; O. R. Skelton, assistant chief engineer; Carl Breer, assistant engineer; and J. O. Hahn, associate engineer.

Promoters of the reorganization expect that a production of 12,000 automobiles and 12,000 tractors will be reached in 1923.

Business Items

The name of the Napier-Bliss Co., Meriden, Conn., has been changed to the Napier Co. Officers of the company will remain as follows: J. H. Napier, president; W. E. Bliss, vice-president; H. M. Smith, secretary; F. W. Rettenmeyer, assistant secretary; and E. A. Schwartz, sales manager.

The Asa S. Cook Co., of Hartford, Conn., has opened an office in Room 505, Superior Bldg., Cleveland, Ohio. Ernest W. Duston is in charge.

The New Process Gear Co., a subsidiary of the Willys Corporation has been awarded a contract for gears for the Durant car. The plant is now running night shifts to keep up the production schedule.

The Eastern Brass and Ingot Corporation, a New York corporation maintaining a brass reclaiming plant in Waterbury, Conn., has gone into the hands of a receiver. G. E. Dalbey, former metallurgist of the company, has been appointed receiver by Judge Edwin S. Thomas of the United States District Court. It was announced that the plant will be closed down for several months.

The Pioneer Metal Goods Corporation, 317 West 125th St., New York, has filed notice of dissolution.

The General Steel and Machinery Co., Detroit, Mich., has arranged for a change of name to the General Steel Corporation, to operate with a capital of $50,000.

The Cleveland Duplex Machinery Co., Inc., of 1224 West Sixth St., Cleveland, Ohio, has been appointed the exclusive representative of the Diamant Tool and Manufacturing Co., Inc., of Newark, N. J. The territory included in the agreement takes in all of Northeastern Ohio.

The Spare Turn Tractor Co., Norfolk, Va., manufacturer of motor tractors, has filed notice of increase in capital from $1,000,000 to $2,000,000, for proposed expansion.

The Illinois Wire and Cable Co., Sycamore, Ill., has arranged for an increase in capital to $450,000.

The Bloomsburg Locomotive Works, Bloomsburg, Pa., recently organized, is said to be arranging for operations at the plant of the Bell Locomotive Works. Improvements will be made in different departments.

The Worm Piston Ring Co., 1002 First National Bank Building, Detroit, Mich., has been organized under state laws with a capital of $50,000, to operate a plant for the manufacture of piston rings, automobile parts, etc. The company is headed by Emil Kottusch, Edgar J. Geist and J. Charles Wood, 4746 Second Ave., Detroit.

The Northwest Foundries, Inc., Rochester, N. Y., has filed notice of increase in capital to $250,000 for proposed expansion.

Officials of the Underwood Typewriter Co., Hartford, Conn., have voted to continue the profit-sharing system at the plant, making the fifth year of operation under the bonus plan. Employees who will share during the present year will include those who have been connected with the company continuously for three years prior to Jan. 1, 1922. As an extension to the plan, arrangements have been made to permit employees who have been with the company for one full year, prior to Jan. 1, to subscribe to either the common stock of the corporation or participation certificates.

Plans for developing the tap, die and screw plate business of the Gardner-Bryan Co., Cleveland, Ohio, are included in the incorporation of the Gardner Tap and Die Co., that city. The new organization will be headed by F. W. Wood, president of the Wood & Spencer Co. and the Cleveland Castings Pattern Co. Associated with him will be J. M. Gardner, vice-president and sales manager of the Gardner-Bryan Co., who will be vice-president of the new company; R. H. Smart, also of the old concern, as treasurer; and D. B. Miller, of the Wood & Spencer Co., as secretary.

The Star Welding Works, at New Orleans, La., has been purchased by Claibourne Andrews and Edward Pickett. A general reorganization of plant and methods will be made.

The Tuthill Supply Co., of Hartford, Conn., has been incorporated under the laws of Connecticut to deal in mill supplies, machinery, etc. The capital stock of the concern is $50,000 and the incorporators are: William D. Tuthill, of 41 Brownell Ave., Hartford; J. C. Kirk, of Hartford; and H. W. Stacy, of Springfield, Mass.

The Rensselaer Machine Co., Inc., has been organized at Rensselaer, N. Y. to manufacture tools, machinery and factory equipment. Incorporators are Henry Billings, 19 Cleveland St., Albany, N. Y.; W. E. Gordon and H. M. Van Alstyne.

The foundry and pattern shop of the Turner-Frick Gas Engine Works, at Sharon, Pa., has been purchased by a group of foundrymen and reorganized as the Star Foundry and Machine Co. Directors include Fred Lutz, J. A. Turner, Joseph Stahl and Lawrence Conway, of Sharon.

Announcement has been made of the merger of the Christopher & Simpson Gear Works, of St. Louis, Mo., with the Decatur Bridge Co., of Decatur, Ill. The new organization will be known as the Mississippi Valley Structural Steel Co., and will have a capital of a million and a half dollars.

The Blake-Fitchburg Pump Co., of Fitchburg, Mass., will move its entire equipment to a new plant in Akron, Ohio.

Worthington Pump and Machinery Corporation has purchased the drawings and patterns covering centrifugal pumps and pumping machinery manufactured by the Camden Iron Works, Camden, N. J.

United Alloy Steel Corporation has taken over the Canton Sheet Steel Co., owned by the Hydraulic Steel Co., of Cleveland, it was announced by E. A. Langenback president of United Alloy. By taking over the new company, 12,000 to 15,000 tons will be added to United's production.

Personals

CHARLES S. CRAWFORD has been appointed chief engineer of the Stutz Motor Car Co. of America, Inc., Indianapolis, Ind. He has at different times been connected with the Lozier, Cole and Premier companies.

B. L. MORGAN has been appointed superintendent of the Erie Specialty Co., Erie, Pa.

JOHN F. SCHURCH has been elected a vice-president of Manning, Maxwell & Moore, Inc., of New York. He will be in charge of the Western sales division, with headquarters in the company's Chicago office at 27 North Jefferson St.

NORMAN R. SEIDLE has resigned as assistant general manager of the Jas. G. Heggie Co., of Joliet, Ill., to become works manager of the General Boilers Co., Waukegan, Ill.

FREDERICK R. PRATT, machinery construction superintendent in Japan for the Whitin Machine Works, manufacturer of cotton mill machinery, of Whitinsville, Mass., left the United States on June 6 for the Orient. Mr. Pratt has been in the United States a short while visiting the plant in Whitinsville.

B. H. BRISTOW DRAPER, vice-president of the Draper Corporation, manufacturer of cotton mill machinery, Hopedale, Mass., sailed from New York recently on a business trip to Europe.

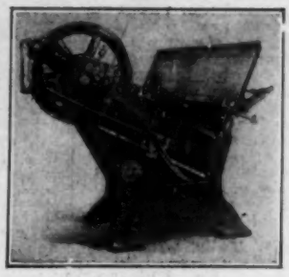
HAROLD P. DAHLQUIST has been promoted to the position of office manager of the Chicago branch office of the Walworth Mfg. Co., wrench manufacturers, Boston, Mass.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Press, Punch, Stagger-Feed, Automatic, Inclined, No. 564-A.
Adriance Machine Works, Inc., Brooklyn, N. Y.
"American Machinist," March 2, 1922

The machine is intended for the production of cans, small shells and jar closures. Lithographic designs can be accurately fed and registered. The scrap is ejected automatically and cut into skeleton frames. Due to the staggered feed arrangement, blanks are punched out with but a thread of metal between them. Only one die is used. The speed is obtained by the continuous action of the punch. The sheet carrier can travel in either direction, holes being punched on both the forward and back movements.

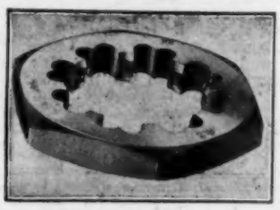


Shaper, Gear, tiple, Vertical-Spindle, Down-Stroke, 6-A
Stevenson Gear Co., Indianapolis, Ind.
"American Machinist," March 2, 1922

The machine operates as a vertical shaper or slotter, except that the tools are stationary and the gear blanks are reciprocated past them. A feed mechanism brings the tools gradually to depth on successive cuts, and an indexing mechanism rotates the gear blank an amount equal to one tooth at every stroke of the ram. The toolhead, a flat steel plate 30-in. in diameter, has a hole in the center and a number of radial grooves in its face. Each machine has two toolheads, one being used while tools on the other are sharpened and reset. Driving power is furnished by a motor in the rear while power for elevating the ram is obtained from a small motor mounted at the back at the right.

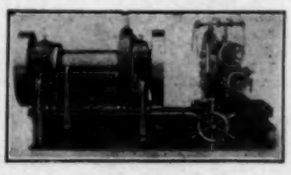
Die, Re-Threading, Hexagon, for Ford Hubs
Greenfield Tap and Die Corporation, Greenfield, Mass.
"American Machinist," March 2, 1922

The die is 2¼ in. in diameter, and has 24 threads per inch. There are eight flutes. The tool is for the use of repair men to refinish the threads on the hub. The threads may thus be put in proper condition after they have been injured.



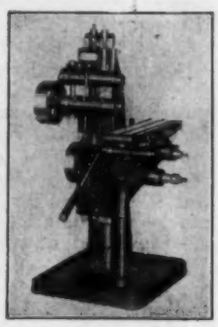
Threading and Cutting Machine, Pipe, 12-In.
Landis Machine Co., Waynesboro, Pa.
"American Machinist," March 2, 1922

The machine uses two dieheads and may be equipped for threading line pipe, oil well casing and hydraulic pipe, or to thread and cut pipe as small as 2½ in. It has a normal range from 4 to 12 in. pipe. The power traverse movement operates either forward or backward, controlled by a lever. Automatic stops prevent the diehead from coming in contact with the chuck, and the carriage from running off the guides. The reamer is fed to the pipe by rotating the cutting-off feed handwheel. Eight variations of speed can be obtained in the speed box.



Milling Machine, Hand, Duplex
Superior Machine and Engineering Co., Detroit, Mich.
"American Machinist," March 2, 1922

The machine is used for slitting step-type piston rings, for sawing apart babbitt-lined automobile crank-shaft bearings and for milling two keyways or slots at the same time. It is driven from the main-line shaft, or can be furnished with a 1½ hp. motor. Graduated dials are provided on all adjusting screws for indicating accurate adjustments. The table is operated by a hand lever, through a rack and pinion. Weight, 900 pounds.



Torch, Cutting, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N. J.
"American Machinist," March 2, 1922

The torch is lighter than the former model, and has two tubes instead of three connecting the head with the handle. Oxygen and acetylene are mixed in a chamber between the handle and the head in a ratio controlled by two needle valves. A special tip is used. The back end of the torch can be removed for cleaning. The number of preheating holes varies from two to six, depending on the combustible gas, the application and the metal to be cut. Bent tips for cutting off rivets are furnished. Butane, hydrogen or even illuminating gas, may be used.

Spindles, Grinding Machine, Belt or Air-Driven, Parker
Ex-Cell-O Tool and Manufacturing Co., 1214 Beaubien St., Detroit, Mich.
"American Machinist," March 2, 1922

The spindles, used for very high speeds, can be furnished to fit any make of grinding machine. A special mounting holds the spindle. The turbine is at the right, inside the cylindrical case. The steel rotor is equipped with thirty buckets on its periphery to which air is carried through two nozzles. Air pressure varies from 40 to 60 lb. per sq. in., depending on speed, which may be as high as 100,000 r.p.m. The belt-driven spindle has two ball bearings for both the spindle and the pulley shaft. No belt pull is placed on the spindle.

Chuck, Drill and Tap, No. 12
SaveAll Tool Co., 49 River St., Waltham, Mass.
"American Machinist," March 2, 1922

The chuck has a friction drive, a positive safety device and a No. 2 Morse taper shank. Its capacity is from ⅛ to ½ in. Collets can be furnished with the size of hole required to hold the drill. The drill is fastened in the collet by a hollow-head setscrew. The device is equipped with a shearing pin and allows drilling at high speed.

Clip, paste on 3 x 5-in. cards and file as desired

T. M. HAMER has recently joined the general sales department of the Gilbert & Barker Manufacturing Co., Springfield, Mass., and will handle the company's interests in Montreal, Canada.

C. C. WELLS, formerly of the Butterfield division, Union Twist Drill Co., Derby Line, Vt., has assumed charge of production for the Vermont Tap and Die Corporation, Newport, Vt.

HENRY WANNAMAKER, formerly of the New York Central Railroad, is now superintendent of motive power for the Boston & Albany Railroad.

FRANK GIBBONS, who has been in the general offices of the Central Steel Co., Massillon, Ohio, for a number of years, has been appointed sales manager for the Cleveland district.

C. C. UPHAM has been elected a director of the Superior Sheet Steel Co., Canton, Ohio. He succeeds E. W. Stevens, who resigned.

WILLIAM J. MERTEN, metallurgical engineer of the Westinghouse Electric and Manufacturing Co., has been elected vice-chairman of the Pittsburgh chapter of the American Society for Steel Treating.

HARRY T. BUSICK, formerly export manager for Young, Corley & Donald, Inc., 115 Broadway, New York, is going abroad to introduce American metal-working machinery in continental Europe. His headquarters will be in Paris. Mr. Busick is undertaking this venture solely on his own account, having no connection with any export firm.

A. H. G. FOKKER, famous Dutch airplane manufacturer, has arrived in the United States to introduce two of his latest model air machines.

Book Reviews

Manual for Engineers. By Charles E. Ferris, B. S., Dean of the College of Engineering, University of Tennessee. Published by the University Press, Knoxville, Tenn. Price 75 cents.

This book, which is pocket size, is in its twenty-fourth edition and contains about fifty tables and other data for engineers and business men. In addition to the tables there are paragraphs here and there which explain the value of education to the individual and to the state, and the value of manual training to negroes. The author states that the object of these paragraphs is to bring before the minds of men who control the affairs of the South, the strongest possible arguments in favor of technical education as a means of developing their resources.

The tables are very complete and cover an unusual variety of engineering data, including: bending moments and shearing force, properties of saturated steam, chimney sizes for boiler horsepower, tensile strains of bolts, calorific values of fuels, draft capacities, logarithms, square and cube roots, areas, specific heats, properties of copper wire, screw thread sizes, equivalent electrical and mechanical units, wiring for circuits and for motor service, as well as interest tables. The advertisements are so worded that they furnish additional information.

Heating and Ventilating. By the late John R. Allen and J. H. Walker. Second edition. Green cloth boards. Three hundred twenty-five 6 x 9-in. pages, numerous illustrations and tables. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York City. Price $3.50.

The second edition was written because of the advances in heating and ventilating that have been made during the last few years. Much of the new material was taken directly from Prof. Allen's writings while director of the research laboratory of the American Society of Heating and Ventilating Engineers during the last year of his life. The book is offered as a text-book for use in engineering and architectural schools and as a handbook for the practicing engineer and architect.

For thorough and exact treatment this volume is to be highly recommended. Equal care has been taken with text and illustrations. Beginning with the subject of heat, the methods of heating and kindred subjects are treated including heat losses from buildings, hot-air furnace heating, properties of steam, radiators, steam boilers, steam heating systems, pipe fittings, valves and accessories, steam piping, hot-water systems, temperature control.

That part of the book devoted to ventilation includes the consideration of air and its properties, fan systems for various types of buildings, design of fan systems, air-washers and air conditioning, central heating.

The appendix includes twenty-six tables that give data on coefficients of heat transmission through building materials and static pressure and capacities for fans.

Better Business Libraries. Talks with Executives—By Louise B. Krause, Librarian. H. M. Byllesby & Co., Chicago, The Indexers Press. Cloth; 5 x 7 in.; pp. 98. $1.30

Many valuable suggestions for the formation, arrangement and use of business libraries are given in this volume. The first two chapters deal with the why and the function of business libraries. The next one is a good plea for the employment of trained librarians. There are chapters on books, periodicals, indexes and digests of periodicals, financial and trade services, government publications (unfortunately confined to Federal Government only), library arrangement and putting business libraries to work. The book deserves the careful attention of all business houses that have or ought to have a good library.

Pamphlets Received

Pistons. Aluminum Manufactures, Inc. Cleveland, Ohio. A reference book for dealers, salesmen, garagemen, mechanics and repairmen. It gives many facts concerning aluminum pistons with explanations of all statements made. The subject matter is divided into sections covering functions of the piston, advantages of aluminum pistons, piston troubles, design, machining aluminum pistons and advantages of lynite pistons. The book has a real message to automotive men.

Professional and Business Books: Scovelle, Wellington & Co., Boston, Mass. A very valuable pamphlet compiled by this company, containing a list of 400 books on accounting, engineering and business topics. Considering the great number of such books published today, this selected list should be of great assistance to anyone seeking to procure a library of high-class reading matter.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A government official in Mexico desires to secure the representation of firms for the sale of construction material (iron and steel), wire cable, plates for shipbuilding, rivets, etc. Quotations should be given f. o. b. New York or New Orleans. Reference No. 2023.

A request has been received from a firm in Sweden desiring to purchase and secure an agency for machinery, tools, pipes and fittings and sanitary appliances. Quotations preferred f.o.b. New York. Reference No. 2066.

A merchant from New South Wales, Australia, is in the United States, and wishes to be placed in touch with manufacturers of agricultural machinery, railway equipment, and other lines which would find a market in that country. Reference No. 2099.

Iron works in Palestine desires to purchase and secure an agency for machine tools, small tools, ice-making machinery, and agricultural machinery. Quotations should be given c.i.f. Jaffa. Reference No. 2018.

A mercantile firm in England desires to secure an agency or the sale of machines for mechanically filling and weighing into sacks from the floor level, granular materials, particularly cement. Quotations preferred c.i.f. English port. Reference No. 2026.

An agency is desired by a firm in Italy for the sale of automobiles and motor cycles, typewriters, and calculating machines. Quotations should be given c.i.f. Italian port. Reference No. 2051.

Trade Catalogs

Thermometers and Pyrometers. Arthur Sachsse Corporation, 6 West 32nd St., New York City. Pamphlet describing a line of Keiser & Schmidt thermo-electric remote-control thermometers and pyrometers.

Cleveland Tramrail Systems. Cleveland Crane and Engineering Co., Wickliffe, Ohio. A catalog illustrating by a series of folders the working of a Cleveland tramrail system in automatic dipping and painting processes.

Ingersoll-Rand Oil Engines. Ingersoll-Rand Company, 11 Broadway, New York City. Bulletin No. 10,004, describing the Price Type "PO" oil engine. The features of this engine are the shape of the combustion chamber and the arrangement and construction of the spray nozzles used for direct-injection of fuel. The engine is illustrated in various stages of completion, showing the individual important parts.

Cross Gear Tooth Rounding Machine. Cross Gear and Engine Co., Detroit, Mich., Circular describing the gear tooth rounding machine made by this company for rounding spur gears, bevel and spiral gear pinions, and for removing burrs on large gears.

Heat-Treating Equipment. The Brown Instrument Co., Philadelphia, Pa. Circular illustrating use of Brown pyrometers and other apparatus in heat-treating operations of manufacturing plants.

Powdered Fuel Equipment. Grindle Fuel Equipment Co., Harvey, Ill., Bulletin No. 4 containing 40 pages of text and illustrations showing various applications of Grindle powdered fuel equipment.

Flexible Shaft Equipment. The Hergi Manufacturing Co., 250 Fifth St., Bridgeport, Conn. Catalog No. 16, describing a line of flexible shaft equipment especially adapted for grinding and screwdriving mechanisms. Several types are illustrated, as well as parts and special attachments for doing different kinds of work.

Catalogs Wanted

The Foreign Trade Department of the Banca Commerciale Italiana, 62-64 William St., New York City, would like to receive catalogs, price lists, statistics and photographs of American-made aircraft, engines, airships, accessories, materials and supplies.

Forthcoming Meetings

American Railway Association: Section III, Mechanical: Annual meeting, Atlantic City, June 14 to 21. (Formerly the Master Car Builders and the Association of Master Mechanics.)

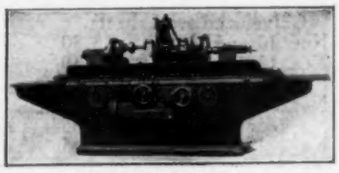
Society of Automotive Engineers: Summer meeting, White Sulphur Springs, W. Va., June 20 to 24. C. F. Scott, 29 West 39th St., New York City, is chairman of the convention committee.

American Society for Testing Materials: Twenty-fifth annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, June 26 to July 1. Secretary, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

Condensed-Clipping Index of Equipment

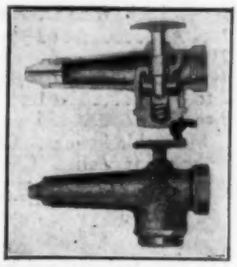
Patented Aug. 20, 1918

Grinding Machine, Automotive Parts, Power or Hand Feed
Cincinnati Grinder Co., Cincinnati, Ohio
"American Machinist," March 2, 1922



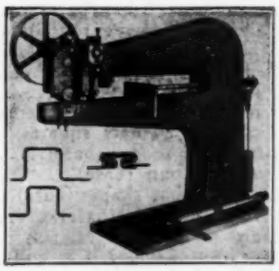
The power-feed machine provides power traverse and automatic reverse to the table, and automatic in-feed to the grinding wheel. The hand-feed machine lacks these, but has fast and slow hand traverse movements. Two back rests with wooden shoes, two adaptors for holding flanged-end cranks, two crankheads, and a universal piston fixture are furnished. For plain cylindrical grinding, footstock and headstock centers, a driving plate and three sizes of driving dogs can be provided. Swing over table, 17 in. Maximum distance between centers, 72 in. Drive, 7 hp. motor. Floor space, 53 x 226 in. Weight, with power feed, 8,030 lb.; with hand feed, 6,600 lb.

Air Gun, Brass
Jenkins Bros., 80 White St., New York, N. Y.
"American Machinist," March 2, 1922



The gun is for use in foundries, machine shops, wood-working and textile mills, electrical stations and garages. The valve, which has a renewable disk, holds tight under pressure and eliminates waste of compressed air from leakage. The disk and seat can be easily removed for cleaning. The air gun is made in ¼ in. size, and with different hose nipples can be used for ¼, ⅜, ½ and ¾ in. hose.

Seam-Closing Machine, Compound, No. 42
Niagara Machine and Tool Works, Buffalo, N. Y.
"American Machinist," March 2, 1922



The machine is for closing side seams of sheet-metal drums. The work is moved forward along the horn by pressure on the treadle and fed between the first set of rolls. These horizontal rolls squeeze the seams together at the bottom, and feed the work automatically through the machine. The second set of rolls flattens and closes the double-locked seam. The pulley runs at 100 r.p.m. Capacity: maximum length, 42 in.; diameter, 13¾ in. Weight, 2,700 pounds.

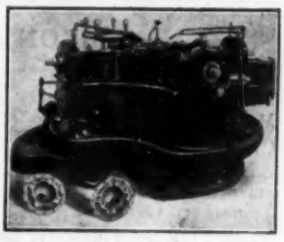
Sanding Machine, Disk, 15-In., No. 182
Oliver Machinery Co., Grand Rapids, Mich.
"American Machinist," March 2, 1922

The machine is used chiefly for sanding circular work up to 15 in. in diameter and duplicating work up to 7 in. wide. The disk head contains the disk shaft, the ball thrust bearing, the exhaust fan which deposits the dust within the column, and the removable disk running at a speed of 1,725 r.p.m. The motor, furnished for either direct or alternating current of 110 or 220 volts, is controlled by a push-button. The table can be tilted 45 deg. downward, or 25 deg. upward by a handwheel. Table: size, 9¾ x 21 in.; height, 37 in.

Drilling Machine, High-Duty, 20-In., No 23
Foote-Burt Co., Cleveland, Ohio
"American Machinist," March 2, 1922

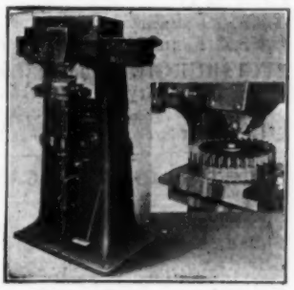
The machine can drive 1¼-in. diameter drills in steel. It has nine changes of spindle speed. When the driving pulley runs at 500 r.p.m., the speeds range from 75 to 610 r.p.m. Three changes of feed give feeds of 0.006, 0.012, and 0.026 in. per revolution, controlled by the levers shown on the head. Table: size, 20 x 16 in.; vertical movement, 22 in. Weight, 2,700 lb.

Drilling Machine, Four-Way, Horizontal
Reed-Prentice Co., Worcester, Mass.
"American Machinist," March 2, 1922



The machine drills simultaneously four holes at right angles and in the same plane, and is intended primarily for drilling gear housings for automobile rear axles. Its spindles can be moved simultaneously by a hand wheel. Power feed can be applied to the four spindles simultaneously by means of a lever at the left, and an automatic trip releases it when the drills break through the work. Maximum distance between opposing spindles, 26 in. Distance spindle to table, 6 in. Spindle travel, 3½ in. Height, 49½ in. Width, 85 in. Length, 96 in. Weight, 7,550 pounds.

Marking Machine, Hydraulic, with Circular Table, No. 12
Martin Machine Co., Inc., Turner Falls, Mass.
"American Machinist," March 2, 1922



The machine has recently been equipped for circular marking. The disk or cutter to be marked is placed on the revolving table, which can be adjusted so as to mark at any radius. Power delivered by a belt operates a rotary oil pump. The oil pressure actuates both the vertical table, raising the work to the die, and the horizontal die-holding slide. Travel: slide, ¾ to 7 in.; table, up to 6 in. Height, 50 in. Floor space, 27 x 22 in. Weight, 1,050 pounds.

Saw, Band, Motor-Driven, Portable, 16-In.
J. D. Wallace & Co., 1401 West Jackson Blvd., Chicago, Ill.
"American Machinist," March 2, 1922

The machine is intended for general use in pattern and carpenter shops. The ½-hp. motor runs at a speed of 1,750 r.p.m., driving the saw at a speed of 3,150 ft. per minute. The removable table, mounted on a large rocker bearing, may be adjusted 45 deg. forward or 5 deg. to the rear. All adjustments are made by handwheels or thumbscrews. The wheels carrying the saw are steel disks 16 in. in diameter. Table, 19 x 21 in., 52 in. high. Capacity, 8 in. in thickness. Height, 5 ft. 9 in. Floor space, 15 x 29 in.

Clip, paste on 3 x 5-in. cards and file as desired

The Weekly Price Guide

Rise and Fall of Market

Advances—Tone of copper market stronger; electrolytic quoted in New York at 14⅝c. as against 14⅜c. Increased supplies of tin on market, quotations reach 32¼c. as compared with 32½c. per lb. last week. Zinc market unusually strong; minimum price 6c. per lb., New York warehouses. Lead quiet, firm. Recent rapid advances in prices of lead and lead products causes advance of ¼c. per lb. in red and white lead, both dry and in oil. Both copper and brass sheets and tubing up ¼c.; brass wire up ¼c. and copper wire 1c.; copper rods up ¼c. and brass rods ¼c. per lb., New York warehouses. Solder also advanced 2c. Slight rise in copper sheets and old metals in Cleveland.

Declines—Break in flax seed market reflected in raw linseed oil quotations of 88c. as against 91c in New York, and 98c. as compared with $1.04 per gal., 5 bbl. lots, one week ago in Chicago.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.52
Northern Basic	25.02
Southern Ohio No. 2	22.50
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	28.56
BIRMINGHAM	
No. 2 Foundry	17.50
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil	26.36
Virginia No. 2	28.34
Basic	23.50@25.50
Grey Forge	25.00
CHICAGO	
No. 2 Foundry local	22.50@24.00
No. 2 Foundry, Southern, sil 2.25@2.75	24.17
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	24.16
Basic	25.00
Bessemer	26.96

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Pittsburgh	9.0	6.0	3.0
Philadelphia	8.5	5.0	3.0
Atlanta	5.5	4.5	4.0
Detroit	7.0	4.5	3.0
Birmingham	12.0	6.5	3.0
Denver	8.0	6.0	5.0
New Orleans	6.0	4.5	3.5
Minneapolis	9.0	6.0	4.5
New York	9@10	6.0	3.0
Cincinnati	6.0	5.0	4.5
Cleveland	6.75	4.5	2.6
Chicago	5.0	4.5	3.5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.40	3.48	3.15	3.38
No. 12	2.45	3.53	3.20	3.43
No. 14	2.50	3.58	3.25	3.48
No. 16	2.70	3.68	3.35	3.58
Black				
Nos. 17 and 21.	3.00	3.15	3.55	4.10
Nos. 22 and 24.	3.05	4.20	3.60	4.15
Nos. 25 and 26.	3.10	4.25	3.65	4.20
No. 28	3.15	4.35	3.90	4.30
Galvanized steel sheets:				
Nos. 10 and 11.	3.30	4.35	3.75	4.30
Nos. 12 and 14.	3.40	4.45	3.85	4.40
Nos. 17 and 21.	3.55	4.75	4.15	4.70
Nos. 22 and 24.	3.70	4.90	4.45	4.85
No. 26	3.85	5.05	4.60	5.00
No 28	4.15	5.35	4.90	5.30

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
		BUTT WELD			
1 to 3	71	58½	⅜ to 1½	44½	29½
		LAP WELD			
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
		BUTT WELD, EXTRA STRONG, PLAIN ENDS			
1 to 1½	69	57½	¾ to 1½	44½	30½
2 to 3	70	58½			
		LAP WELD, EXTRA STRONG, PLAIN ENDS			
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	66%	53%	60½%	47½%	62½%	48½%
2½ to 6 in. steel lap welded	61%	47%	58½%	44½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32–5% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.00	6.00	4.50
Spring steel (light) (base)	8.00	6.00	6.00
Coppered Bessemer rods (base)	7.00	8.00	6.03
Hoop steel	3.38	2.81	3.13
Cold rolled strip steel	6.25	8.25	6.35
Floor plates	4.70	4.66	4.98
Cold finished shafting or screw	3.35	3.00	3.30
Cold finished flats, squares	3.85	3.50	3.80
Structural shapes (base)	2.58	2.41	2.38
Soft steel bars (base)	2.48	2.31	2.28
Soft steel bar shapes (base)	2.48	2.31	2.28
Soft steel bands (base)	2.98	....	2.88
Tank plates (base)	2.58	2.41	2.38
Bar iron (2.00@2.10 at mill)	2.48	2.21	2.28
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
5/32	8.00		12@13
⅛	6.50		11@12
1/16 to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.62½
Tin, 5-ton lots, New York	32.12½
Lead (up to carlots), St. Louis, 5.90; New York	6.25
Zinc (up to carlots), St. Louis, 5.65; New York	6.00

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	18.00
Antimony (Chinese), ton spot	6.50	7.50	6.25
Copper sheets, base	20.50	20@21	23.00
Copper wire (carlots)	16.00	16.50	16.25
Copper rods (ton lots)	19.00	21.50	19.50
Copper tubing (100-lb. lots)	22.50	23.00	23.00
Brass sheets (100-lb. lots)	16.75	17.50	18.75
Brass tubing (100-lb. lots)	19.75	19.00	20.50

—Shop Materials and Supplies

METALS—Continued

Brass rods (1,000-lb. lots)	14.75	15.50	15.75
Brass wire (carlots)	17.25	17.75	.....
Zinc sheets (casks)	8.50	17.25	15.75
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J	39.00	.....	....
Solder (½ and ½), (caselots)	23.00	22.00	19.00
Babbitt metal (fair grade)	35.00	42.00	36.00
Babbitt metal (commercial)	15.50	16.00	9.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.50	11.75	10.25
Copper, heavy, and wire	12.00	11.25	9.25
Copper, light, and bottoms	10.00	9.50	8.25
Lead, heavy	4.75	5.75	3.65
Lead, tea	4.25	3.50	3.00
Brass, heavy	7.00	6.50	8.00
Brass, light	6.00	5.00	4.75
No. 1 yellow brass turnings	6.50	6.00	5.00
Zinc	3.00	3.00	2.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

	New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:			
IC, 20x28, 112 sheets	20.00	18.25	18.50
IX, 20x28, 112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:			
IC, 20x28, 112 sheets	17.00	16.00	17.00
IX, 20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright			
Prime, 20x28 in.:			
100-lb., 112 sheets	12.50	11.00	14.50
IC, 112 sheets	12.80	11.40	14.80
Terne Plate			
Small lots, 8-lb. Coating:			
100-lb., 14x20	7.00	5.60	7.25
IC, 14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb	.055@.09	.09	.09
Wiping cloths per M., 13¼x13¼	.....	50.00	55.00
Wiping cloths per M., 13¼x20½	.....	55.00	65.00
Sal soda, 100 lb. lots	2.80	2.50	2.65
Roll sulphur, 360 lb. bbl., per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.88	.95	.98
White lead, dry or in oil	100 lb. kegs.	New York, 12.50	
Red lead, dry	100 lb. kegs.	New York, 12.50	
Red lead, in oil	100 lb. kegs.	New York, 14.00	
Fire clay, per 75 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per net ton	$7.00@$7.25	
Coke, prompt foundry, Connellsville	per net ton	$7.00@$7.50	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	60–10%	60–10%	60%
1½ and 1¼x3 in. up to 12 in.	60%	60-10-10%	60-10%
With cold punched sq. nuts	40%	.....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	45%	.....	$4.00 off
Button head bolts, with hex. nuts	30%	$3.90 net	.....
Hex. head and hex. nut bolts	35%	.....	65-5%
Lag screws, coach screws	60–5%	.....	60-5%
Square and hex. head cap screws	75–10%	75%	70-10%
Carriage bolts, up to 1 in. x 30 in.	45%	60%	50–5%
Bolt ends, with hot pressed nuts	55%	.....	55%
Tap bolts, (h. h. plus std. extra of 10%)	15%	.....	.....
Semi-finished nuts ⅜ and larger	70%	75–5%	80%
Case-hardened nuts	65%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$5.00	$3.50	$3.50
Washers, cast iron, ⅜ in. per 100 lb. (net)	5.00	3.50	3.50
Washers, round plate, per 100 lb. Off list	5.00	....	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	3.25	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	3.25	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	3.25	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	3.25	3.50	4.00
Rivets:			
Rivets, ½ in. dia. and smaller	60-10%	70%	60-10%
Rivets, tinned	60-10%	70%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$3.70	$3.25	$3.00
Cone heads, ditto (net)	3.80	3.35	3.10
1½ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.35 base
Copper rivets	60–5%	50%	50-10%
Copper burs	40%	50%	.....
Lard cutting oil (50 gal. bbl.) per gal.	$0.65	$0.50	$0.67½
Machine oil, lubricating, (50 gal. bbl.) per gal.	0.45	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls)			
Leather.			
Light grade	50%	50–5%	60–10%
Medium grade	40–5%	40–10–2½%	50%
Heavy grade	35%	40%	40–5%
Rubber and duck:			
First grade	60–5%	50–10%	40 10%
Second grade	60–10–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets, Flint paper	$5.84	$3.85	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	32.75	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	.....	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	.....	1.49
Cloth	3.02	.....	3.20

New and Enlarged Shops

Machine Tools Wanted

Ala., Montgomery—Janney & Co., founders and machinists, C. L. Carr, Purch. Agt.—sheet metal working machine for pressing small parts about 6 x 12 in.

Cal., Oakland—H. A. Werum, 2150 34th St.—one turret lathe, automatic, with at least 4½ in. hole through spindle.

Ga., Rome—Davis Fdry. & Machine Wks., I. F. Davis, Pres.—one 10 x 14 ft. boring and turning mill.

Ill., Chicago—The Illinois Central R.R., 29 South La Salle St., J. J. Bennett, Purch. Agt.—

Three 18 in., one 20 in., three 24 in. and two 30 in. engine lathes.

One 2½ x 24 in., three 3 x 36 in., one 24-28 in. heavy duty type with 7 in. hole through spindle five 54 in. vertical, four 42 in. vertical, one 15 in. brass and one 15 in. spring turret lathes for miscellaneous brass work.

Four combination axle lathes for turning axles with wheels mounted.

One 54 in. car and one 90 in. driving wheel lathes.

Thirteen 12 or 14 in. x 6 ft. bolt lathes.

One heavy duty type suitable for machining locomotive rods, rod threads and similar parts, one No. 3 vertical and one No. 3 horizontal E type heavy duty milling machines.

One 2 in. double head, one ½ in. triple head and one 2½ in. double head bolt threading machines.

One 1 in. rapid bolt heading, one 2 in. and one 3 in. forging machines.

One heavy duty punch and shear.

One combination punch and shear with capacity to punch and shear plate up to 3-16 in.

Eight 36 in. special railroad draw cut and one 32 in. heavy duty crank shaper.

Two 96 in. 600 ton driving wheel presses.

Three 36-40 in. heavy duty upright drill presses, one 20 in., and one 36-40 in. vertical drill presses.

One 72 in. heavy duty radio drill.

Two Universal reamer and cutter and one guide bar grinders.

Seven 18 x 3 x 1½ in. double floor grinders with 2 grinding wheels.

One twist drill grinder and one 96 in. link grinder for general radius grinding of locomotive links.

One 6 in. metal hack saw.

One set of 6-7 ft. and one set of 6 ft. bending rolls with capacity for bending sheets up to ⅛ in. in thickness.

One 300 lb. power hammer.

One 56 in. x 18 ft. heavy duty planer with 2 heads on cross rail and 2 side heads.

Two 100 in. vertical boring mills.

One heavy duty type slab miller.

Two 11 lb., one 2,50 lb. and one 5,000 lb. steam hammers.

Four 48 in. car wheel bores.

Two 75 ton forging presses.

Kan., Cheney—E. J. Robinson—forging machinery, forge, set of blacksmiths tools, drill, press, lathe, grinding machine, all power equipment.

Kan., Hutchinson—The Hutchinson Fdry. and Machine Co.—Cincinnati, Norton or Landis grinder, 60 in. between center, 17 in. over carrier, fitted for crank shaft grinding swivel head to permit surface grinding, and an attachment for piston grinding.

Kan., McPherson—Pitts Machine Shop—one power lathe.

Kan., Newton—The Jones Motor Co.—small bench lathe for turning armatures, and one large upright drill with 16 in. travel.

Kan., Wichita—E. L. Billings, 221 South Lawrence St.—complete equipment for garage including drill press, lathe and emery wheel, power driven.

Kan., Wichita—Brown Bros., 217½ West Douglass St.—one power lathe.

Kan., Wichita—De Long Machine Wks, 703 East Murdock St.—one power lathe.

Kan., Wichita—W. Dyer, 229 South Lawrence St. (garage)—drill press, lathe, emery wheel and cylinder grinder for power equipment.

Kan., Wichita—East Central Garage, 923 East Central St., L. J. Campbell, Purch. Agt.—power drill press, emery wheel, and lathe.

Kan., Wichita—J. A. Kammerer, 1016 East Murdock Ave., (auto parts)—one emery wheel and one drill press for power equipment.

Kan., Wichita—H. Loffinger, 118 North Emporia St. (garage)—lathe, drill press and emery wheel for power equipment.

Kan., Wichita—R. McMillian, 204 South Topeka St.—one power lathe.

Kan., Wichita—Wichita Welding & Machine Wks., 200 South Topeka St., P. Elkman, Purch. Agt.—power lathe and drill press.

Mich., Grand Rapids—New Era Spring and Specialty Co., Cottage Grove Ave., S. W.—punch press, back geared, with 5 in. stroke.

Mich., Grand Rapids—Northland Lumber Co.—power shear and punch, with 24 in. throat, to shear 2½ in. bars.

Mich., Saginaw—C. F. Berger, 209 North Water St.—machine shop equipment.

Mo., Kansas City—Solomon & Barnett, 1509 Main St.—small tools for machine shop.

Mo., St. Louis—J. O. Coleman, 106 North 3rd St.—foot power lathe and electric grinders.

N. J., Jersey City—H. E. Cooper, 339 Grand St.—2 presses and rotary slitting shears.

N. J., Mt. Holly—A. Shreve (accessories and repair shop)—foot power screw-cutting lathe and vulcanizing machine.

N. J., Plainfield—W. Woltz, 1244 Arlington Ave.—one rivet, back geared precision lathe.

N. Y., Buffalo—Jerge Motor Co., Inc., 1647 East Genesee St.—equipment for proposed service station and machine shop.

N. Y., Copenhagen—Deer River Power Co., Central Sta.—one portable electric drill, 110 volts; portable forge and blower for field shop.

N. Y., New York—F. and M. Novelty Co., 75 Spring St., S. Marcus, Purch. Agt.—one small size screw machine.

N. Y., New York—The Superior Skylight Co., Inc., 456 4th Ave.—three drill presses, 2 power saws, emery wheels, several vises, 4 combination punch and shears.

N. Y., Watertown—L. Sager Co., Court St.—small lathe suitable for tool room, (new or used).

N. Y., West Falls—W. Reader—machinery, repair tools and equipment for garage now in course of construction.

O., Cincinnati—Economy Mchy. Co., 428 East Pearl St., J. Flynn, Sr., Purch. Agt.—6 small speed lathes 8 in. swing; 2 Brown and Sharpe, small screw machines, (used).

O., Cincinnati—Jones Machine Tool Co., 435 East Pearl St., dealer in used machinery, W. F. Jones, Purch. Agt.—one 14 ft. vertical boring mill, arranged for motor drive, (used).

O., Columbus—Higgy-Avery Co., 1199 Franklin Ave., (radio and electrical apparatus), F. E. Avery, Vice-Pres.—two screw machines, 1 drill press, 2 grinders, and 1 cutting machine.

O., Lima—W. H. Harper, Jr., 1021 West High St.—hand power straight shear for ¼ in. plate.

Pa., Erie—Erie Metal Furniture Co., E. Bauschard, Secy.—Welders, lathes, and miscellaneous machinery for new factory.

Pa., Phila.—Alfred Box Co., Front and Poplar Sts., manufacturers of elevators and hoists—boring machine, drills, riveting machine, small tools etc.

Pa., Phila.—Fidelity Machine & Mfg. Co., 4015 Paul St.—equipment for shop addition.

Pa., Phila.—O. Hoffman, 3rd and Cayuga Sts. (machinist)—several new machines for addition, including boring machine, lathe, etc.

Pa., Phila.—G. W. Lindsay, 5120 Wakefield St.—additional equipment for machine shop.

Pa., Pittsburgh—The Levenson Co., 33 Pride St.—single end punch with architectural jaw to punch holes in ⅞ in. plate.

Pa., Titusville — Titusville Tank and Constr. Co., c/o W. O. Carlson and J. Martin—machinery and equipment to manufacture and repair steel tanks, tank cars, boilers and all kinds of metal plate construction work.

Wis., Iron River—M. Happie—one belt driven lathe mill.

Wis., Kenosha—E. B. Moericke, 915 Salem Ave.—repair machinery for proposed garage.

Wis., Milwaukee—J. L. Austin Mfg. Co., 419 Van Buren St., (hardware specialties and power heads)—machine tools including lathe, drill press, etc.

Wis., Milwaukee—H. E. Krueger, 1040 Holton St.—mechanical baking equipment.

Wis., Milwaukee—Rundle Mfg. Co., 27th and Cleveland Ave. (plumbing fixtures), H. Held, Purch. Agt.—edge grinders.

Ont., Owen Sound—Bd. of Educ., F. H. Rutherford, Secy.—equipment for manual training department, and for physics and chemistry laboratories of proposed technical school.

Ont., Tillsonburg—S. E. Barrett—equipment for garage and auto repair shop now under construction.

Que., Montreal—P. Beaubien, 1675 Masson St.—equipment for garage and repair shop.

Que., Montreal—C. Day, 49 Lincoln Ave.—machinery and equipment for garage and repair shop.

Que., Montreal—A. Fortier, 1875 Cote de Neiges Rd.—bench tools for auto repair shop.

S. A., Para, Brazil—A. de Albuauerque, caixa postal 230—machines for cutlery work, also machines for making axes, hatchets, etc.

Machinery Wanted

Fla., Jacksonville — Florida Fly Exit Screen Co. c/o T. B. Elton, Mgr.—screening and woodworking machinery for proposed factory.

Ga., Rome—Battery Mchy. Co., L. D. Yeargon, Purch. Agt.—one 10 x 10 latest model Ingersoll-Rand belt-driven air compressor (used).

Ill., Chicago—Alemite Die Castings and Mfg. Co., 2640 Belmont Ave.—nickel plating outfit, 6 volts, 2,000 amperes.

Ill., Chicago—M. Lange, 3735 North Whipple St.—cylinder press and job press.

Ill., Freeport—C. E. Meyer & Co., 327 East Spring St.—vinegar presses.

Ill., Oak Park—Oak Park Oak Leaves, 1112-24 North Blvd.—new power cylinder press, linotypes and printing equipment for daily newspaper.

Ia., Des Moines—Des Moines News, The Arcade — newspaper equipment, presses, linotype machines, etc.

Kan., Wichita—The Star, 1241 Wabash Ave., H. T. Simms, Purch. Agt.—one 6 column power cylinder press for newspaper work; prefer Babcock press.

Ky., Franklin—Vi-Car Oil & Refining Co., Inc., J. L. Nimal, Purch. Agt.—machinery and equipment for new refining.

Mich., Detroit — A. Rosenthal, 636 Catherine St. — woodworking machinery suitable for making store fixtures.

Minn., Minneapolis—Ry-Krisp Co., 2120 Lyndale Ave., S., food products, J. G. Priedeman, Secy.—two motors, hangers and shafting, for building now in course of construction.

Mo., St. Louis—Kitlark Electric Mfg. Co., 3940 Easton Ave.—polishing machinery and power equipment.

N. J., Camden—Kieckhofer Container Co., Thorne and Cooperwood Sts., manufacturers of containers—saw tables, cutting knives, moulding machines, riveting machines for paper boxes, and metal working machines.

N. Y., Alleghany—J. Eisert—medium size, power, cream separating machine.

N. Y., Attica—W. Ranger—1 rip saw with table, either wood or iron.

N. Y., Binghamton—T. Snopek, R. F. D. No. 5—machinery and equipment for saw and planing mill.

N. Y., Buffalo—Buffalo Smelting Co., Inc., 12 Peoria St., G. Giesser, pres.—machinery and equipment to smelter and refine copper, brass and other metals, for proposed plant on Tonawanda and Pacific Sts.

N. Y., Buffalo—Buffalo Tool & Supply Co., 20 Henry St.—woodworking machinery.

N. Y., Buffalo—City of Buffalo, Commissioner of Parks and Bldgs., Room 6, Municipal Bldg.—will receive bids until June 12 for refrigeration machines.

N. Y., Buffalo—F. W. Fidler, 19 Lovering Ave.—welding machines.

N. Y., Buffalo—J. W. Kawczynski, 27 LaTour St.—machinery to manufacture ice boxes, show cases, counters and soda fountains.

N. Y., Buffalo—Natl. Biscuit Co., Inc., 217 Ellicott St.—air washing, purifying machinery, heating and cooling devices and electric power plant for new bakery now under construction.

N. Y., Buffalo—L. P. Reimann, 69 North Division St., contractor and manufacturer of ladders—small machinery and equipment for proposed addition to ladder shop.

N. Y., Buffalo—Standard Oil Co. of N. Y., 1103 Elk St.—machinery and equipment for proposed pump house.

N. Y., Buffalo—A. R. Ziebarth, 217 Leroy Ave.—machinery to manufacture wood and metal automobile bodies.

N. Y., Chaumont—Adams, Duford Co., (quarrys), E. B. Johnson, Purch. Agt.—heavy duty swing cut-off saw and limestone rock drills for compressed air operation.

N. Y., Lewiston—Cuyler Packing Co., Inc.—machinery and equipment for new packing house.

N. Y., New York—Erie R.R., 50 Church St., W. R. Collins, Mgr. Purch.—machinery for locomotive repair shops at Hornell, N. Y. List not yet compiled.

N. Y., Niagara Falls—Defiance Paper Co., Walnut and 3rd Sts.—large paper making machine, capacity 30 ton per day, for new $200,000 addition.

N. Y., Rochester—C. F. Dietz, 81½ Adams St.—saw mills, new or used.

N. Y., Rochester—E. T. Gilbert Mfg. Co., 228 South Ave.—1 power paper cutting machine, 32 in. or larger.

N. Y., Rochester—F. E. Wyner, Portland Ave.—small machinery air compressor, etc., for accessory and gas station.

N. Y., Waterloo—Geneva Preserving Co., 59 Swift St.—special machinery and equipment to manufacture and pack sauerkraut.

N. Y., Webster—Webster Co-operative Cold Storage Assn., machinery and equipment for proposed cold storage plant.

N. C., Asheville—Felstone Co., Haywood Bldg.—machinery for the manufacture of concrete blocks and some woodworking machinery.

N. D., Valley City—Valley City Peoples Opinion, W. G. Strieb, Purch. Agt.—printing equipment and book folder.

O., Columbus—Henderson Tire and Rubber Co., Goodale St. and Hocking Valley R.R., C. O. Henderson, Pres. and Mgr.—2 vulcanizing machines.

O., Zanesville—C. Findeiss & Son, Muskingum Ave., (manufacturer of leather)—modern tanning machinery, belt driven.

Pa., Chester—Chester Lace Mills, Clayton and Trainer Sts.—spindles and knitters.

Pa., Marienville—Marienville Express, J. A. Haas, Purch. Agt.—cylinder newspaper press and one 8 x 12 Price job press.

Pa., McKeesport—W. R. Dillon, 1406 Jenny Lind St.—machinery and complete outfit for the manufacture of pop beverages.

Pa., Phila.—G. Barrie & Sons Co., 1313 Walnut St.—equipment for printing plant.

Pa., Phila.—Dearnley Bros. Worsted Co., Chetlen Ave. and Boynton St., J. S. Dearnley, Purch. Agt.—cards, combs, spinning spindles, etc.

Pa., Phila.—C. H. Mastland & Sons, Westmoreland and Collins Sts., (carpet weavers)—broad looms and narrow looms.

Pa., Phila.—A. J. Reach & Co., Tulip and Palmer Sts.—leather working machines, winding machines, small tools, lathe, etc.

Pa., Phila.—Thompson Printing Co., 312 Cherry St.—additional presses and equipment for new plant.

Pa., Phila.—T. Wolstenholme & Sons Co., Frankford Ave. and Westmoreland St.—L. F. Schaeffer, Purch. Agt.—spindles, worsted card and combs.

Pa., Pittsburgh—South Pennsylvania Oil Co., 331 4th Ave.—machinery and equipment for large gasoline plant now in course of construction at Van, Pa.

Pa., Rochester—Amer. Borax Co., Inc., c/o W. C. McKinney, Dir., 6334 Forbes St., Pittsburgh— machinery for the manufacture or cultivating of raw borax.

Pa., Sharon—Star Fdry. and Machine Co., North Water Ave., J. Brahney, Genl. Mgr.—equipment for cast iron and steel foundry now under extensive repairs.

Pa., York—Frick Co. Inc., 48 East Market St.—equipment for new foundry now in course of construction.

Va., Roanoke—White Fdry. Co., 613 10th Ave.—foundry equipment and machinery.

Wis., Cudahy—Bd. of Vocational Educ., J. P. Beuscher, Secy.—equipment and machinery for proposed vocational school.

Wis., Milwaukee—Callaway Fuel Co., 703 North Water St., E. Callaway, Purch. Agt.—motor driven coal handling machinery.

Wis., Milwaukee—C. Hach, 694 Linus St.—mechanical baking equipment, electric motor.

Wis., Milwaukee—The Van Buren Garage Co., Martin and Van Buren Sts.—gas storage tank with pump for proposed garage.

Wis., Niagara—Niagara Journal, R. R. Elliot, Purch. Agt.—typesetting machine.

Wyo., Casper—Mid-Western Torpedo Co., Inc., J. L. Wilson, Genl. Mgr.—special machinery to manufacture nitro-glycerine.

N. S., Halifax—Hillis & Son, 209 Hollis St.—equipment for proposed foundry.

Ont., Tara—Hespeler Novelty Co. Ltd.—equipment and machinery to manufacture novelties.

Ont., Toronto—F. F. Fry, Ltd., 43 Scott St., G. O. McClay, Purch. Agt.—air compressing outfit with drills, also drilling steel.

Mex., Mexicali—Italian Fruit Packing Co., Ltd., J. B. Scolari, Treas.—machinery and equipment for a chain of fruit packing houses to be constructed along western coast of Mexico.

Metal Working Shops

Cal., Merced—The Directors of the Merced Irrigation District will soon award the contract for the construction of a 1 story garage and machine shop. I. W. Hoover, Planada, Archt.

Conn., Stamford—Victor-Page Motors Corp., Farmingtondale, N. Y., has awarded the contract for the construction of a 1 story, 60 x 90 ft. factory addition here, on Melrose St. Estimated cost $30,000. Private plans.

Ill., Chicago—G. S. Kingsley, Archt., 109 North Dearborn St., is receiving bids for the construction of a 1 story, 125 x 150 ft., garage at 3301-3309 North Halsted St., for G. Wittbold Co., 745 Buckingham Pl. Estimated cost $90,000.

Ia., Atlantic—Shranger & Johnson, Inc., manufacturer of lightning rods and specialties, has awarded the contract for the construction of a 1 story factory.

Mass., Cambridgeport—Simplex Wire & Cable Co. has awarded the contract for the construction of a 4 story, 90 x 100 ft. factory addition on Green St. Estimated cost $75,000.

Mass., East Cambridge (Boston P. O.)—Boston & Maine R.R., North Station, Boston, is receiving bids for the construction of a 1 story 80 x 250 ft. repair shop, here. Estimated cost $100,000. A. B. Corthell, c/o owner, Ch. Engr.

Mass., Lowell—Middlesex Machine Co., Paige St., has awarded the contract for the construction of a 1 story, 50 x 75 ft. shop, on Lee St., for the manufacture of plumbing supplies. Estimated cost $20,000. Private plans.

Mass., Salem—The Hygrade Lamp Co., 60 Boston St., has awarded the contract for the construction of a 4 story, 50 x 100 ft. factory. Estimated cost $75,000.

Mass., Westfield—The Foster Machine Co., South Broad St., manufacturer of textile machinery, has awarded the contract for the construction of a 1 story, 80 x 120 ft. addition to its plant, also for 3 other structures, each 30 x 50 ft., for various uses. Estimated cost $40,000.

Mich., Detroit—The Hupp Motor Car Co., East Milwaukee St., is building a 4 story 79 x 400 ft., and a 4 story 52 x 396 ft. addition to its plant on East Milwaukee and Mount Elliott Aves. Estimated cost $200,000. C. D. Hastings, Pres. and Genl. Mgr.

N. J., Belleville—Thompson Machine Co. is receiving bids for the construction of a 2 story factory. Estimated cost $150,000. Fletcher-Thompson, Inc., 542 Fairfield Ave., Bridgeport, Conn., Engrs. and Archts. Incorrectly noted in May 15 issue, under "Melville."

N. J., Camden—W. C. Davis, 731 Hunter St., has awarded the contract for the construction of a 1 story, 45 x 100 ft. garage, at 1388 Haddon Ave. Estimated cost $60,000.

N. J., De Lair—The Kieckhofer Container Co., Thorne and Cooperwood St., Camden, has awarded the contract for the construction of a 1 and 2 story container factory, here. Estimated cost $500,000.

N. Y., Buffalo—Hotel Statler, Inc., Washington and Swan Sts., plans to build a garage, 800 car capacity, on Mohawk St.

N. Y., Buffalo—Jerge Motor Co., Inc., 1647 East Genesee St., plans to build a 102 x 105 ft. service station and machine shop. Estimated cost $18,000. Architect not announced.

N. Y., Glendale (Long Island)—V & O Press Co., Dry Harbor Rd., manufacturer of power presses and sheet metal working machinery, will soon receive bids for the construction of a 1 story, 100 x 500 ft. factory addition. Private plans.

N. Y., New York—Dochterman Realty Co., c/o J. M. Felson, Archt. and Engr., 1133 Bway., will soon receive bids for the construction of a 2 story garage at 11 Jane St. Estimated cost $100,000.

N. Y., Syracuse—Gere & Willis, Inc., 320 West Genesee St., plans to build a 60 x 264 ft. garage, service station and repair shop, on West Genesee St. Estimated cost $100,000.

O., Cleveland—The J. L. Free Co., real estate, 1004 Prospect Ave., has had plans prepared for the construction of a 2 story, 110 x 110 ft., garage on Prospect Ave. Estimated cost $75,000. Watoon Eng. Co., Cook Bldg., Archts and Engrs.

O., Cleveland—R. Haldi, 10020 Detroit Ave., has awarded the contract for the construction of a 1 story, 60 x 80 ft. garage. Estimated cost $40,000.

O., Cleveland—The Independent Towel & Supply Co., 1822 Central Ave., is receiving bids for the construction of a 1 and 3 story, 80 x 100 ft. and 70 x 90 ft. laundry and garage, at 1822 Central Ave. Estimated cost $100,000. Christian, Schwarzenbery & Gaeda, 1900 Euclid Ave., Archts.

O., Cleveland—I. Margolin, 10527 Churchill Ave., is having plans prepared for the construction of a 2 story, 50 x 123 ft. garage on East 105th St. Estimated cost $60,000. M. Weis, Union Bldg., Archt.

O., Cleveland—The Ohio Crank Shaft Co., 982 East 152nd St., had plans prepared for the construction of a 1 story, 60 x 200 ft. factory, at 6600 Clement Ave. Estimated cost $60,000. W. J. Wefel, 1836 Euclid Ave., Archt.

O., Cleveland—Sands Mfg. Co., 5407 Sweeney Ave., has awarded the contract for the construction of a 2 story, 65 x 100 ft. factory for the manufacture of water heaters, on East 55th St. and Sweeney Ave. Estimated cost $40,000. Private plans.

O., Cleveland—The York Ohio Ice Machine Co., 1106 Woodland Ave., has had plans prepared for the construction of a 1 and 2 story, 100 x 132 ft., office, warehouse and factory on West 28th St. and Washington Ave. Estimated cost $60,000. E. McGeorge & A. G. Simon, 1900 Euclid Ave., Archts.

O., Euclid—O. E. Brown, c/o Elf Motor Co., 7000 Euclid Ave., Cleveland, is having plans prepared for the construction of a 1 story garage. Estimated cost $40,000. Private plans.

O., Lakewood (Cleveland P. O.)—W. C. Schultz, 11913 Detroit Ave., will soon award the contract for the construction of a 1 story 76 x 97 ft. garage and commercial building, on Detroit and Love Aves. Estimated cost $40,000. O. N. Chamberlin, 1532 Spring Garden Ave., Archt.

Pa., Bradford—Bradford Refining Co. has awarded the contract for the construction of a refinery on Foster Brook. Estimated cost $50,000. L. E. Mallory, Jr., Newell Bldg., Secy. Private plans.

Pa., Enola—Pennsylvania R.R., Broad St. Sta., Phila., will soon receive bids for the construction of a 1 story 100 x 600 ft. repair shop, here. Estimated cost $500,000. A. C. Shand, Ch. Engr.

Pa., Phila.—The Commercial Truck Co., Hunting Park and Rising Sun Ave., has awarded the contract for the construction of a 3 story, 160 x 175 ft. garage and service station on Franklin Sq. Estimated cost $500,000.

Pa., Phila.—H. S. French, c/o P. H. Tyre, Archt., 1509 Arch St., will soon receive bids for the construction of a 5 story, 80 x 100 ft. sales and service station on Girard and Frankford Aves. Estimated cost $250,000.

Pa., Phila.—G. W. Lindsay, 5120 Wakefield St., has awarded the contract for the construction of a 2 story, 40 x 100 ft. machine shop at 5116 Wakefield St. Estimated cost $35,000. H. N. Miller, 34 South 17th St., Archt.

Pa., Phila.—Philadelphia Trainrail Co., 109 West Tusculum St., has awarded the contract for the construction of a 1 story, 60 x 90 ft. factory, for the manufacture of switches and frogs, on Ontario and Weckel Sts. Private plans.

Pa., Pittsburgh—Fleischmann Co., 701 Washington St., New York City, is having plans prepared for the construction of a 2 story, 75 x 175 ft. garage, warehouse and office building on Allegheny and Western Sts., here. Estimated cost $50,000.

Pa., Pittsburgh—Jones & Laughlin Steel Co., 3rd Ave. and Ross St., is having plans prepared for the construction of a 1 story, 200 x 200 ft. roll plant, machine shop and polishing plant, on South 27th and 28th Sts. D. L. McKeel, c/o owner, Engr.

Pa., Primos—Jones Machine Wks., 53rd St. and Landsdown Ave., Phila., has awarded the contract for the construction of a 1 story, 60 x 200 ft. machine shop, here. Estimated cost $50,000. Private plans.

Pa., Titusville—Titusville Iron Wks. Co., plans to build a large foundry. Estimated cost $40,000. Private plans. J. W. Boone, Secy. and Treas.

Pa., Williamsport—C. F. Dietrick, Windsor Café, Pine St., plans to build a 2 story, 90 x 150 ft. garage and repair shop on Hepburn St. Estimated cost $100,000.

R. I., Providence—The Winsor & Jerauld Mfg. Co., 223 Harrison St., manufacturer of textile machinery, has awarded the contract for the construction of a 1 story, 50 x 150 ft. and 20 x 60 ft. addition to its factory, on Harrison St. Estimated cost $40,000.

Wis., Appleton—Wisconsin Traction, Heat, Light & Power Co., is taking bids for the construction of a 1 story, 50 x 86 ft. garage and service station. Estimated cost $45,000. D. C. Beaulieu, Appleton, Engr.

Wis., Kenosha—E. B. Moericke, 915 Salem Ave., is receiving bids for the construction of a 1 story 50 x 125 ft. garage. Estimated cost $50,000. Private plans.

Wis., Milwaukee—Nash Motors Co., Clement Ave., has awarded the contract for the construction of a 3 story, 100 x 400 ft. addition to its factory. Estimated cost $250,000. Private plans.

Wis., Milwaukee—Van Buren Garage Co., Martin and Van Buren Sts., has awarded the contract for the construction of a 1 and 2 story 90 x 126 ft. garage. Estimated cost $65,000.

Wis., Racine—Belle City Incubator Co., 15th St., has awarded the contract for the construction of a 2 story, 60 x 85 ft. factory for the manufacture of incubators. Estimated cost $25,000. J. Robar, Pres. Private plans.

Wis., Waukesha—The Spring City Auto Co., 220 West Main St., is having revised plans prepared for the construction of a 1 story, 34 x 150 ft., addition to its garage. Estimated cost $40,000. M. F. White, 68 Wisconsin St., Milwaukee, Archt.

N. S., Halifax—Hillis & Son, 209 Hollis St., has awarded the contract for the construction of a foundry. Estimated cost $50,000. Engineer not announced.

Ont., Port Colborne—The International Nickel Co. of Canada, Ltd., is receiving bids for the construction of a 1 story, 94 x 384 ft. electrolytic nickel refinery. J. T. Kemp, Asst. Genl. Mgr.

Ont., Tilisonburg—S. E. Barrett is building a garage and auto repair shop. Estimated cost $42,000.

General Manufacturing

Cal., Colusa—California Prune and Apricot Growers, Market and San Antonio Sts., San José, are having plans prepared by their engineering and construction dept., A. Grubb, in charge, for the construction of a 1½ story packing plant on Coopers Extension Tract, here. Estimated cost $125,000.

Ill., Chicago—Roberts & Oakes, 141 West Jackson Blvd., plans to build a packing plant on 45th St. and Racine Ave. Estimated cost $500,000. Architect not selected.

Me., Lewiston—The Lewiston Bleachery & Dye Wks., Lisbon St., will soon award the contract for the construction of a 3 story, 40 x 110 ft., addition to its sheeting department. Estimated cost $45,000. Private plans.

Me., Pittsfield—Amer. Woolen Co., Lawrence, Mass., wll soon award the contract for the construction of a 3 story 50 x 90 mill addition, here. Estimated cost $40,000. Private plans.

Me., Rumford—The Oxford Paper Co., has awarded the contract for the construction of a 2 story addition to its plant. Estimated cost $50,000.

Mass., Easthampton — Hampton Co., Pleasant St., has awarded the contract for the construcion of a 5 story, 70 x 100 ft. addition to its cotton mercerizing plant. Estimated cost $300,000.

Mass., Newton—Shepherd Worsted Mills has awarded the contract for the construction of a 1 story, 45 x 145 ft. dyehouse on California St. Estimated cost $35,000. Private plans.

Mass., North Andover—Suttons Mills will soon award the contract for the construction of a 1 story, 70 x 105 ft. (worsted) weave shed. Estimated cost $35,000. The Russell Co., 50 State St., Boston, Plant Mgrs.

Minn., South St. Paul—R. N. Katz Packing Co., South St. Paul, and 352 East 6th St., St. Paul, is having plans prepared for the construction of a 3 story, 50 x 130 ft. packing plant and a 1 story, 34 x 36 ft. office building. Estimated cost $100,000. Henschien & McLaren, 37 West Van Buren St., Chicago, Archts.

N. H. Laconia—The Pitman Mfg. Co. has awarded the contract for the construction of a 3 story, 65 x 100 ft. dyehouse for textile plant. Estimated cost $60,000.

N. J., Camden—Haddon Press Co., New Park Ave. and Whitehorse Pike, has awarded the contract for the construction of a 1 story, 90 x 440 ft. printing plant, on 19th and Federal Sts. Estimated cost $225,000.

N. Y., Alden—Erie County, Court House, Buffalo, is having plans prepared for the construction of various buildings including administration building, shop, laundry, bakery, women and juvenile buildings, on the County Farm, here. Estimated cost $150,000. G. Diehl, Ellicott Sq., Buffalo, County Engr. W. J. Beardsley, c/o County Engineer, Archt.

N. Y., Clyde—A. D. Collier plans to build a cold storage plant of 60,000 bbl. capacity. Estimated cost $180,000 to $200,000. Architect not selected.

N. Y., Newark—Phillips-Werth Optical Co., Rochester, N. Y., has awarded the contract for the construction of a 1 story 52 x 175 ft. optical factory on North Main St.

N. Y., Palmyra—Meadowbrooks Products Co., Inc., extracts and toilet preparations, C. B. Beal, Purch. Agt.—small machinery for manufacture of extracts.

N. Y., Yonkers—Alexander Smith & Son, Elm Ave., has awarded the contract for the construction of a 4 story, 16 x 206 ft. addition to its plant for the manufacture of carpets. Estimated cost $300,000.

N. Y., Webster—Webster Co-operative Cold Storage Assn., has awarded the contract for the construction of a 4 story cold storage plant.

N. C., Asheville—Felstone Co., Haywood Bldg., will soon receive bids for the construction of a 1 story, 50 x 100 ft. factory for the manufacture of concrete blocks, etc. Estimated cost $15,000-$18,000. Private plans. W. L. Gravatt, Secy.

O., Canton—The Hygienic Products Co., 715 Walnut St., S. E., manufacturer of cleaning powder, has awarded the contract for the construction of a 2 story, 50 x 70 ft. factory. Estimated cost $40,000. Noted June 1.

O., Cleveland—The Ingraham Waste & Supply Co., 1539 Columbus Rd., plans to construct a 2 story, factory and warehouse at 1450 Hamilton Ave. Estimated cost $50,000. Architect not selected. W. E. Monsor, Pres.

O., Cleveland—Rothkopf Bros., 6112 Central Ave., will soon award the contract for the construction of a 2 story 36 x 130 ft. dairy at 10712 Superior Ave. Estimated cost $75,000. A. Sogg, 319 Hippodrome Bldg., Archt.

O., Cleveland—The Ward Baking Co., c/o J. B. Arthur, St. Marys St. and Southern Blvd., New York, has awarded the contract for the construction of a 3 and 5 story, 240 x 315 ft. bakery on East 45th St. and Windsor Ave., here. Estimated cost $500,000. Noted March 23.

O., Dayton—The Dayton Biscuit Co., Webster St., has awarded the contract for the construction of a 3 story, 75 x 90 ft. factory. Estimated cost $75,000.

O., Eaton—Eaton Farmers Equity Co. has awarded the contract for the construction of a grain elevator and mill. Estimated cost $17,500.

O., Youngstown—The Ward Baking Co., St. Marys St. and Southern Blvd., New York, has awarded the contract for the construction of a 3 story, 114 x 231 ft. bakery, here. Estimated cost $250,000. Noted April 6.

Pa., Chester—Chester Lace Co. has awarded the contract for the construction of a 1 story, 60 x 80 ft. lace factory. Private plans.

Pa., McKees Rocks—The Chesebrough Mfg. Co., 17 State St., New York City, is having plans prepared for the construction of a 2 and 3 story, 143 x 195 ft. plant for the manufacture of vaseline, consisting of 7 buildings, including power house, boiler house, warehouse and manufacturing buildings. Estimated cost $500,000. Hunting Davis Co., Century Bldg., Pittsburgh, Archts.

Pa., Phila.—H. Barton & Sons Co., 109 South 3rd St., will soon award the contract for the construction of a 2 story, 40 x 105 ft. factory, for the manufacture of sand paper and abrasives, in the Holmesburg Dist. Estimated cost $25,000. Tilden & Register, 1525 Locust St., Archt.

Pa., Phila.—The Deamley Bros., Chester Ave., has awarded the contract for the construction of a 3 story, 74 x 98 ft., spinning factory on Chester Ave. and Boynton St. Noted April 27.

Pa., Phila.—Sax & Hilbert, Engrs., Penfield Bldg., will soon receive bids for the construction of a 4 story, 100 x 133 ft. factory, for the manufacture of sporting goods, on Memphis and Eyre Sts., for A. J. Reach Co., Tulip and Palmer Sts. Estimated cost $200,000.

Pa., Phila.—Thompson Printing Co., 312 Cherry St., has awarded the contract for the construction of a 5 story, 80 x 120 ft. printing plant, at 1127 Callowhill St. Estimated cost $200,000. Ballinger Co., 12th and Chestnut Sts., Archts.

Pa., Rochester—Amer. Borax Co., Inc., c/o W. C. McKinney, Dir., 6334 Forbes St., Pittsburgh, plans to build a 3 story, 400 x 600 ft. borax factory. Estimated cost $150,000. Architect not announced.

Pa., Rochester—Davies Ahrens McKiney Co. is having plans prepared for the construction of a 1 story 30 x 50 ft. power plant and two 3 story 50 x 100 ft. factory buildings, for the manufacture of boracic acid. Estimated cost $90,000. Austin Co., 16112 Euclid Ave., Cleveland, O., Engrs.

Pa., Washington—Observer Publishing Co. is having revised plans prepared for the construction of a 2 story, 60 x 150 ft. printing plant on Main St. Estimated cost $150,000. W. L. Stoddard, 9 East 40th St., New York City, Archt.

R. I., Woonsocket—The Peerless Dyeing & Finishing Co., c/o Woonsocket Spinning Co., plans to construct two 1 story dye houses on Fairmount St. Estimated cost $50,000. Private plans.

Wis., Racine—Wright Rubber Products Co. has awarded the contract for the construction of a 1 story, 60 x 120 ft. rubber factory on Lazard St. Estimated cost $40,000. Private plans.

Ont., Hamilton—Firestone Tire & Rubber Co., South Main St., Akron, O., will soon receive bids for the completion of a tire and rubber factory, here, 3,500 tires daily capacity. Private plans.